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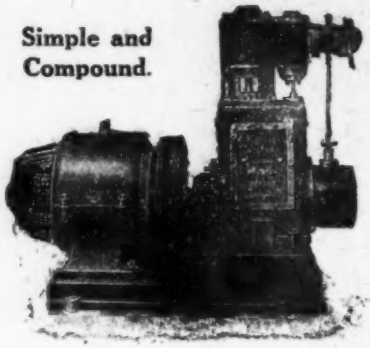

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WAR INDEMNITY IN ELECTRICAL MACHINERY.

IT is highly probable that the war indemnity which Germany will be required by the Treaty of Peace to pay to the Allies will consist partly of money, with payments extended over a number of years, and partly of goods or manufactures or constructions in some form or other. It has to be borne in mind, however, that if Germany can obtain the necessary raw materials, any orders given to that country for manufactures will tend to assist in the industrial reconstruction of the nation; and this assumption also applies to the requisitions which will be made for the delivery of goods as partial liquidation of the indemnity. It should, therefore, be in the interest of the Allies to demand payment in money as far as possible, distributed over a series of years, and to accept manufactures to a minimum extent, except in so far as they can be, mainly or exclusively, produced from raw materials existing in the country—or, better still, to require the surrender of the raw materials themselves, which the Allies could transform into finished products. On the other hand, the Allies control, directly or indirectly, various raw materials which are necessary for the rehabilitation of German industries; and it is, therefore, desirable that the tonnage of these allotted to Germany should not unduly exceed the quantities needed for the production of those manufactures which that country will be called upon to supply as part of the indemnity, leaving to the discretion of the Allies the question of future supplies after the delivery of the manufactures, which will be specified, has been completed. It is by no means the duty of the Allies to assist Germany beyond the stage represented by the satisfaction in full of the claims which will soon be set forth in concrete form.

We feel constrained to make the preceding remarks by reason of the fact that an influential French contemporary, in the course of numerous articles dealing with the war indemnity, demands the delivery of enormous quantities of coal, potash, iron and steel, railway permanent-way material and rolling stock, ships, electrical machinery and apparatus, mechanical equipment, chemical products, motor-cars, &c. It is pointed out that Germany exported electrical machinery and plant in 1913, of the then value of the equivalent of £14,500,000, of which generators, motors, transformers, &c., represented £2,800,000; cables, £1,950,000; telephones, £450,000; apparatus for lighting, electrolysis, and the transmission of power, £3,700,000; and measuring instruments, £1,200,000; whilst the balance was constituted by other plant. Under these circumstances it is suggested that the German electrical industry would be able to deliver to France the machinery necessary for the equipment of those waterfalls which are not yet utilised, for new generating stations, and for the multiplication of the tramways and the conversion of the

railways to electric traction. The hydro-electric works in France prior to hostilities only represented 750,000 H.P., which has scarcely been doubled during the war, whereas it is contended that the water-power used for electrical purposes really ought to amount to 10,000,000 H.P. It is, therefore, argued that the indemnity in electrical machinery, plant, and apparatus, should reach hundreds of millions of francs, if not milliards of francs.

It is certainly desirable for the Allies to secure full and adequate compensation, and although a considerable tonnage of coal and iron and steel is already being procured from Germany, it is advisable for the reasons given for the Allies not to accept any manufactures other than those which are absolutely essential for their purpose. By all means let us have what is necessary in manufactures, but we should refrain from any steps which would facilitate the industrial regeneration of the enemy and pave the way for the war of revenge which the industry-controlling classes are said already to cherish either on the account of Germany alone, or in conjunction with Russia in the future.

Since the preceding observations were written it has transpired that Germany is to be permitted to export certain classes of goods as a result of the further agreement which was reached at Brussels on March 14th. This agreement applies only to the period of the Armistice, and the financial proceeds derived from the exports will be devoted to the payment for the food products which the Allied Governments have undertaken to supply to Germany. According to the official statement on the question issued by the Supreme Economic Council at Paris, the permissive exports concerned under the agreement include coal, dye stuffs, certain classes of iron and steel and electrical and certain other types of machinery. The Allied Governments have the option of purchasing two-thirds of the quantity or value of the merchandise or manufactures to be exported, whilst the remainder can be disposed of as Germany may desire. In both cases, however, the values or credits receivable will be, as already mentioned, applied to the liquidation of the account for food supplied. It is understood that the prices to be paid in the case of Allied purchasers will be arranged between representatives of the Allies and those of Germany at Cologne. We have carefully perused the last issues of an influential French contemporary in order to ascertain, if possible, whether any additional light could be thrown upon the question of electrical and other machinery comprised within the list of permissive exports, but have seen no further information on the problem; nor have we found any statement dealing with the subject in the German newspapers, down to the present time.

Electricity v. Gas.

The perennial discussions as to the relative merits of gas and electricity remind us of the ancient problem: Why does a tub full of water not overflow when a live fish is put into it? This remarkable phenomenon was gravely argued by the sages until some highly practical but unsophisticated fellow tried the experiment.

In very much the same way we are solemnly informed from time to time that, according to calculations, covering sheets of foolscap, electricity is so unsuitable a medium for lighting, heating, and cooking, that it stands no chance whatever in comparison with gas.

We do not wish to make invidious comparisons; we are not in the least concerned to decry the merits of gas—in these days we are all out for harmonious co-operation, not for conflict—but we cannot be expected to stand aside when an unprovoked onslaught is made upon our industry. Such an attack was made by Sir Dugald Clerk, as briefly reported in our last issue, and he was backed up by Lord Moulton, who even went so far as to advocate the use of small gas engines for domestic purposes—the limit of hardihood. The amazing thing is that, like the sages of old, these gentlemen gave no heed to realities, but limited their mental vision to abstractions. *What are the facts?*

There is no need, in this case, to go away and try experiments—the facts are clamant, obtrusive, inexorable. Above all, they are reflected *in the quarterly accounts*—the most convincing of all arguments. Where electric lighting is substituted for gas lighting, the cost is less, and the service better; where electric cooking is substituted for gas cooking, the cost is about the same, and the cooking far better done; where electric heating is used, the cost is certainly greater than with gas, but nothing like as much as calculations would show, and as Col. Crompton pointed out, the benefits are far greater. The reason is that in each case the work is done by electricity far more *efficiently* than with gas—much less electricity is used than paper calculations indicate. It is a matter in which experience proves the case in the face of the most elaborate arguments and computations.

But what about motive power? Sir Dugald wisely touched upon this lightly—his case for gas would have been ruined if he had done otherwise. We make bold to say that electrical motive power was one of the chief factors in winning the war. Let those who would question this statement go to Sheffield, Birmingham, Manchester—any industrial town; or to the Ministry of Munitions; and ask "What did Electricity do in the Great War?" The enormous increase in the output of electrical energy in itself tells the story, which moreover is put into the plainest language by the three official reports on the Electrical Trades after the War, and Electric Power Supply. It is much too late in the day to try to depose electricity from its position of unquestionable superiority.

The weak point of the electrical case is the waste of by-products, including heat, with which it is at present almost always associated, and here is the point at which the electrical and gas interests should collaborate. Each has its proper place and appropriate uses; there is nothing to be gained by internecine warfare—let peace and co-operation prevail here also, for the good of the State, and let us have done with misleading academic disputations.

Removing the Shackles on Trade.

It was scarcely to be expected that anything absolutely definite would be forthcoming from the questions put and the statements made in Parliament concerning the future regulation of this country's exports and imports. This remark is not made wholly in a spirit of adverse criticism. We are not going to revive the talk of "Dilly and Dally." One problem which the authorities have to face is what goods, raw or semi-manufactured, needed in our industries, should be allowed free entry immediately, and what goods, semi-manufactured or wholly-manufactured, likely to compete with a struggling British industry, should be kept out, at any rate, until the industry is firmly established. Electrical manufacturers will realise probably more vividly than any others the complicated nature of this problem. It is encouraging to learn that the President of the Board of Trade has now decided that the Advisory Council, which was set up some time ago at the War Trade Department, to advise him on import and export

restrictions, should be formed into a sort of Commission, and be reinforced by the addition of representatives of all interests. This step has been taken none too early, seeing that the Armistice was signed more than four months ago. However, Mr. Bridgeman hoped the Commission would sit "continuously," and we believe, in fact, that the Committees into which it has formed itself are sitting almost daily, reviewing all the imports now restricted, as well as the other imports into the United Kingdom, with a view to recommending a percentage of the normal which is to be admitted. We trust that the results of these recommendations will soon be made public, so that manufacturers and merchants may know how they are likely to be placed during the transitional period. In the meantime, they have to be content with the promise that no import restrictions shall be, or shall continue to be, imposed on goods coming from any part of the Empire without the special consent of the Cabinet, that raw materials required for our industries shall now be admitted, free of restriction, and that semi-manufactured articles which are necessary as material for the manufactures of this country are to be admitted free from restrictions, except so far as they are produced by industries which it is essential to foster in this country, and which require shielding, in which case they will be restricted: and, finally, that manufactured articles shall be subject to restriction when not necessary for consumption in this country. As regards the period of any restriction which may be in operation, Sir A. Geddes has stated that this is not to be extended beyond September 1st without further review. Such, then, is as much as we know about the import problem.

As regards exports, we welcome the relaxations of prohibitions which are announced almost daily, and we acclaim Mr. Bridgeman's statement that the Board of Trade is at present considering how it is possible to reduce the prohibited list to the lowest possible dimensions. We have seen no good case made out—other than Blockade reasons—for retaining control over exports, and let us hope that means will be arrived at in Paris, without delay, for removing all hindrance on export trade.

Wireless Telegraphy after the War.

The value of the services rendered to the cause of civilisation by wireless telegraphy during the war can hardly be exaggerated. What position will it hold in the future? and what part will the amateur be permitted to play in its development and use?

Before the war a system of licensing and inspection by the Post Office authorities was in force, which allowed to amateurs a reasonable degree of freedom, whilst maintaining a very necessary surveillance over their operations. As Mr. Marconi recently pointed out, not only was wireless telegraphy in great part created by amateur workers, but also the latter, when war broke out, were able to place at the disposal of the Admiralty and the War Office a body of experience and enthusiasm which was of the greatest value to the nation. Obviously steps should be taken to ensure that if, unfortunately, such another emergency should arise, a similar reserve of skilled operators would be available; it costs nothing to the State, while it is constantly in readiness for immediate utilisation. We very gladly, therefore, support an appeal which was published in the March issue of the *Wireless World*, urging that the restrictions which at present absolutely bar the amateur worker from riding his hobby shall be removed at the earliest possible moment. As our contemporary points out, the number of persons interested in the subject has immensely increased since 1914; if their enthusiasm can be kept alive, it will constitute a priceless asset—and the only way by which this can be accomplished is by according them liberty to experiment, of course, under suitable regulations.

In this connection we were very pleased to publish, last week, the announcement that the Institution of Electrical Engineers had taken active steps to provide full opportunity within its organisation for discussion of the subject and for the dissemination of the greatly extended knowledge which has been gained during the war. It is admitted that in wireless telegraphy—despite the poisonous interference of the politicians—this country has always led the world; no means should be left unutilised, not only to maintain that position, but also to increase our advantage; and the first step to be taken is undoubtedly to enlist the interest and activities of the amateur in wireless research.

Trade Union Amenities.

The decision of Mr. Justice Astbury, in the recent case of Valentine *v.* Hyde and Howard (see the *Times* Law Reports, Vol. XXXV, p. 301), ought to encourage employers not to submit tamely to the dictates of a Trade Union. His Lordship held that where members of a Trade Union threaten a fellow-employé, who is a member of another Trade Union, that they will obtain his discharge unless he joins a Trade Union different from the one to which he belongs, and where they exercise moral intimidation, undue influence, and coercive pressure upon the employer to attain that object, such threats are an unlawful interference with the rights of the employer, and the pressure exercised on the employer amounts to an unlawful interference with the rights of his employé which is actionable at common law and is not protected by Sec. 3 of the Trades Disputes Act, 1906.

The evidence showed that the defendants, in their capacity of secretaries of some unions, both wrote to the plaintiff's employer, and called upon him with reference to his further employment of the plaintiff. No threat or warning was uttered, but following on the visit the plaintiff's employer informed him that if he and some other workmen did not join the defendants' Union, he would dismiss them. As the plaintiff refused to join, he was, in fact, dismissed, but the dismissal was suspended pending the result of the application for an injunction, which, as we have seen, was granted by the Judge.

It is to be observed that the litigation in this case was between a workman and a Trade Union—not between an employer and a Trade Union. Suppose that the defendants had said: "Unless you dismiss him (the plaintiff) we shall call your other men out." Would an action have lain against the Union? Upon the authority of Mr. Justice Astbury's judgment, it would certainly lie at the suit of the workman; but would it lie at the suit of the *employer?* That is where the Trades Disputes Act, 1906, seems to come in. Were he to bring an action to prevent his men being called out, that would be an attempt to obtain redress for something done in furtherance of a trade dispute which (to use the words of Sec. 3 of that amazing piece of legislation) "is not actionable on the ground only that it induces some other person to break a contract of employment or that it is an interference with the trade, business, or employment of some other person or with the right of some other person to dispose of his capital or labour as he wills." So the Trade Unions were declared to be above the law in 1906; and it is the exercise of these powers thus accorded to them which is responsible for many of our present-day labour difficulties. Instance a case which has recently come to our ears. A contract was secured to erect certain works in the country. After his tender had been accepted, the builder was confronted with a resolution of the Bricklayers' Union to the effect that no bricklayer should lay more than 500 bricks a day. Realising that, apart from expense, this spelt delay, the contractor summoned the men. "Look here," he said, "if any of you will lay 1,000 bricks in a day, or more for that matter, I'll pay at the rate of a day's pay for each 500!" Several volunteered, and proved themselves well able to earn several days' pay in one day. But it may be supposed there was too much "free trade in ability" about this to please the ca' canny party. In two or three days the employer had a letter from London to say that unless he dismissed the energetic workers the slackers would be called out! And he was compelled to submit.

And yet this is a free country, in which we are often heard to boast of "the rule of law." It would be exceedingly interesting to hear of an action being brought by an employer in the circumstances we have mentioned.

ELECTRICITY SUPPLY AT SMETHWICK.

There are few spheres, we should think, in which more remarkable progress has been made during the last few years than in that of public electricity supply. The phenomenal expansion of electricity supply undertakings has been truly remarkable, and, therefore, no excuse is necessary in presenting the following review of the most important changes that have taken place in yet another undertaking—namely, the Shropshire, Worcestershire, and Staffordshire Electric Power Co., which supplies the Smethwick and Dudley districts, and of which Mr. G. T. H. Legge is chief engineer.

Prior to the war the expansion of the undertaking was normal, the plant capacity at the outbreak of war standing at 12,475 kw. The company, however, was no exception to the general rule, and as the load grew, additional plant had to be installed to meet the constantly-increasing demand. During the war, plant with a capacity of 24,250 kw. has been installed at the Smethwick and Dudley stations (which two stations operate in parallel), and thus (allowing for the removal of an old 400-kw. d.c. set at the latter station) the total capacity to date is brought up to 36,325 kw. The consulting engineer in connection with the large extensions which have been made during the last four years has been Mr. C. W. G. Little.

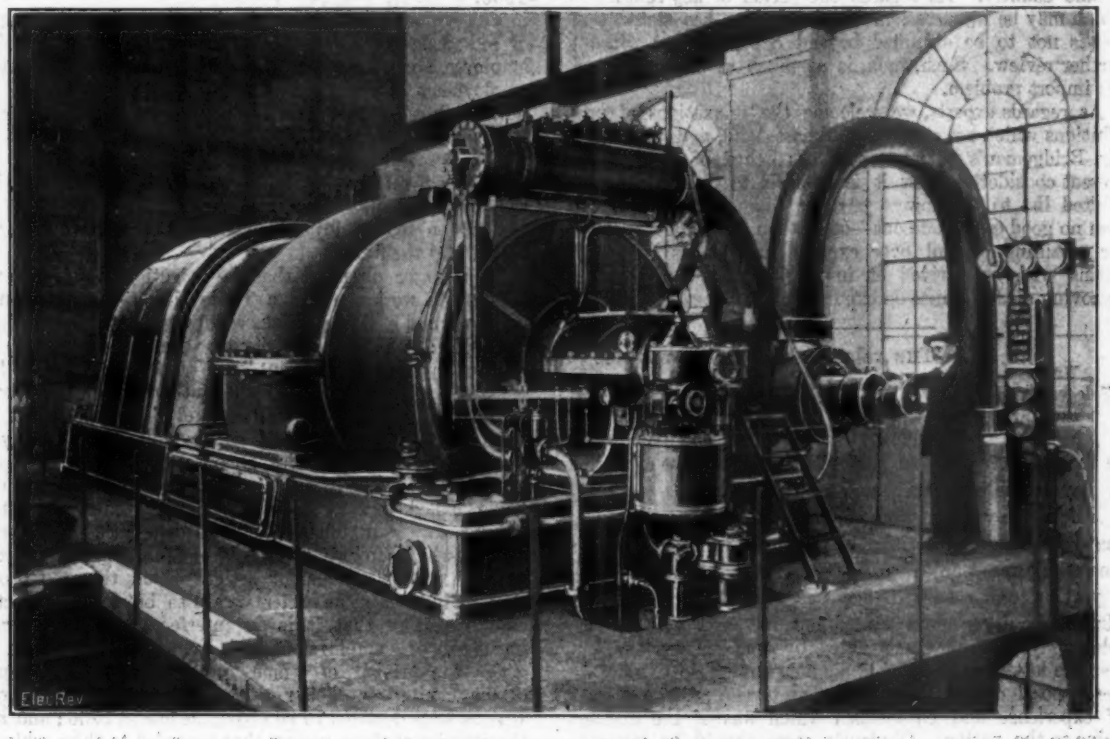


Fig. 1.—An 8,000-kw. B.T.H. Turbo-Generator at Smethwick.

At the Dudley station a 2,000-kw. turbo-alternator set by the Brush Electrical Engineering Co., Ltd., has been installed, together with the necessary new e.h.t. switchgear, which is by the British Thomson-Houston Co., Ltd. Considerably more activity has taken place, however, at the Smethwick station, where the remainder of the new plant has been installed. In this station the original plant was supplied by the Brush Co., but is, however, of the Brush-Parsons design and many years old. In addition to the plant at Dudley, this company has recently supplied a considerable number of transformers for use in connection with this system.

At the Smethwick station a new turbo-house has been built, in which two 8,000-kw. turbo-alternators by the British Thomson-Houston Co., Ltd., have been installed—one in 1917 and the other in 1918. These two sets are duplicates, and each is capable of an output of 10,000 kw. for two hours. One of these sets is shown in fig. 1. They are carried above the condensers, which are on the ground level. Each machine is remote-controlled from the main switchboard in the old turbo-house, a complete set of telegraphs and indicating instruments being provided for each machine.

Each turbine exhausts into two condensers, coupled to the turbine by means of a special breeches piece, thus permitting either condenser to be cleaned while the turbine is operating on one half of the total condenser surface. The condensers, supplied by Messrs. Willans & Robinson, Ltd., have cast-iron shells, and represent ordinary modern standard practice; each has a surface of 8,000 sq. ft., the tubes being ¾ in. in external diameter. The condensate is withdrawn by means of two-stage, motor-driven centrifugal pumps, arranged in such a manner that either condenser can be shut off from the condensate pumps, or either pump can be shut down. The air is extracted from the condensers by means of stationary water jets, the water supply to which is coupled up from the main circulating-water inlet pipe. There are two water nozzles arranged in parallel in such a manner that each can be operated separately, if desirable. They are coupled to a common air pipe, to which the two condensers are connected by means of a Y piece. The circulating water is supplied from the main system of the station, but it is possible to isolate each condenser from the cooling-water supply, the whole arrangement being so designed as to permit of the cleaning of each condenser while the plant is in use.

Spanning this new turbo-house is a 45-ton electrically-driven crane, supplied by Messrs. Holt & Willetts, of Cradley Heath. The old 20-ton hand-operated crane by Messrs. Vaughan & Son, of Manchester, in the old turbo-room is being converted to electric drive, and its lifting capacity increased to 30 tons.

At the outbreak of war, the plant, all in the old turbo-room, an interior view of which is shown in fig. 2, consisted of three 500-kw. B.T.H. alternators, direct coupled to Brush reciprocating engines. One of these sets is now being removed to make room, and the other two will be dispensed with as required. There were also three

turbo-alternator sets by the Brush Electrical Engineering Co., Ltd., two being rated at 1,000 KW. each, and the third at 2,000 KW., while a 4,375-KW. turbo-alternator set, by the British Thomson-Houston Co., Ltd., was put to work just prior to the outbreak of hostilities. A complete surface condensing installation in connection with this set was supplied by Messrs. Worthington-Simpson, Ltd., capable of dealing with 68,500 lb. of steam per hour on the basis of a vacuum of 27·5 in., with the barometer at 30 in. and with cooling water at 80°. The plant, complete with connections, piping, valves, and instruments, consists of one cylindrical steel-shell condenser, having 9,500 sq. ft. of cooling surface; one vertical triplex "Edwards" air pump, size 20 in. by 12 in., running at 130 R.P.M., and having one 8 in. by 10 in. vertical single-acting attached lift pump, and a 27-B.H.P. motor running at 720 R.P.M.; and one twin centrifugal condensate pump, size 16 in., delivering at the rate of 8,000 gallons per minute, against a total frictional and static head of 60 ft. The pump is driven by a 185-B.H.P. motor, at a speed of 720 R.P.M., the efficiency of the machine being 79 per cent.

The third large set installed in this station since 1914 consisted, in the first place, of a Brush-Dick, Kerr set. Trouble was experienced with this machine, the turbine stripping itself, and as the set could not be done without, a B.T.H. turbine, which happened to be available at the time, was substituted for the Brush machine. The alternator, by Messrs. Dick, Kerr & Co., Ltd., is rated at 5,555 K.V.A., or 5,000 KW. at 0·9 power factor; it is a three-phase, 25-cycle machine at 5,500 volts pressure, and running at 1,500 R.P.M. A direct-coupled exciter is provided, and the efficiency figures are as follows:—At half-load, 91·5 per cent.; three-quarter load, 94 per cent.; full load, 95 per cent.; and five-fourth load, 95·5 per cent.

The local traction load is supplied by two 300-KW. rotary converters, while the whole of the station auxiliary plant is gradually being changed over from D.C. to A.C., bringing it into line with the new plant. A sub-station is being built on to the end of the turbine house to accommodate a 1,000-KW. bank of transformers to supply the station auxiliaries. Each transformer will be placed in a separate brick cubicle on the ground floor, so that in case of fire any one transformer may be entirely isolated from the rest. On the top floor of the sub-station a new air filter and fan for the 6,250-K.W. B.T.H.-Dick, Kerr set is to be installed.

An exterior view of the station at Smethwick is given in fig. 3, which also shows the cooling towers and telphers.

With the increasing capacity of the station, additional switchgear has naturally had to be provided, and the whole of the E.H.T. switchgear has been remodelled and considerably extended. This work has been carried out by the British Thomson-Houston Co., Ltd., and consists of moulded stone cells containing the high-tension apparatus and oil switches, the latter being mechanically remote-

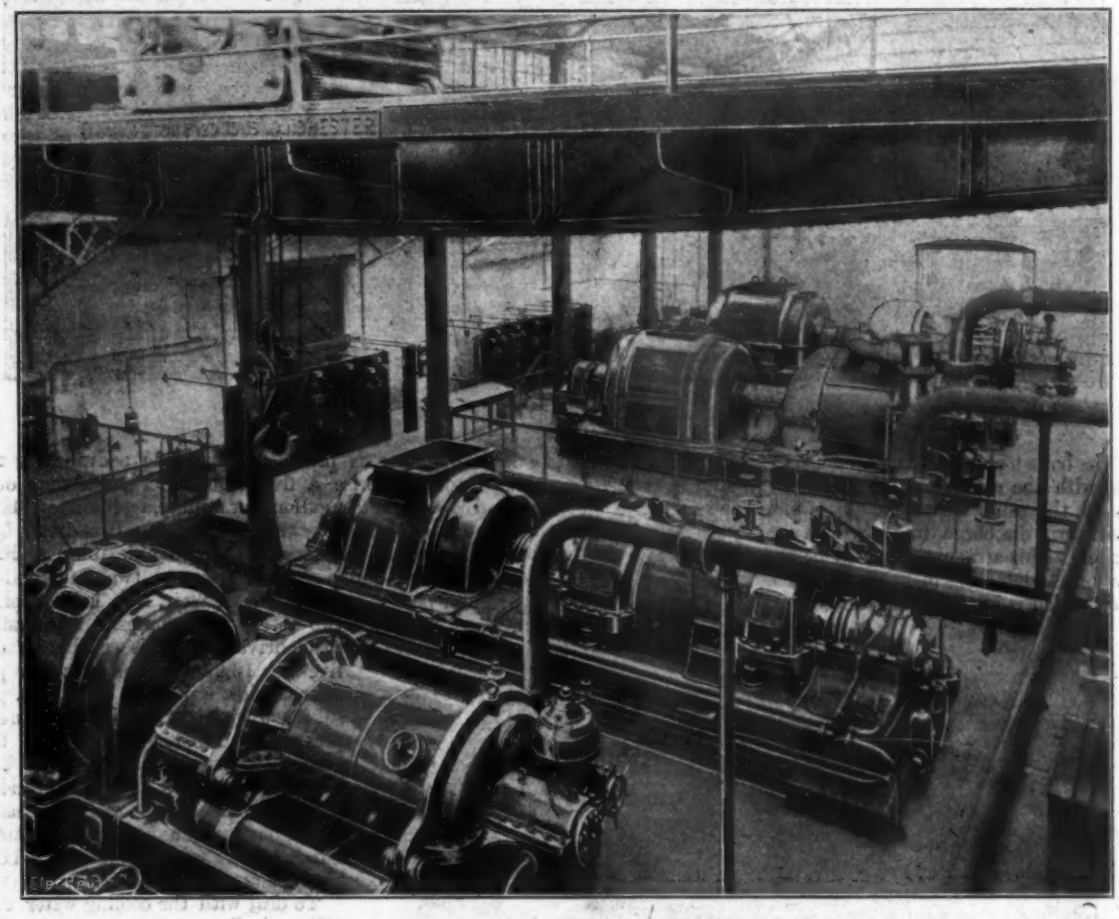


FIG. 2.—INTERIOR OF OLD TURBO-ROOM AT SMETHWICK.

controlled from the control panels mounted on the gallery above the basement in which the cells are located. The switches themselves are of the B.T.H. heavy-tank type. The bus-bars are sectionalised through reactances, the latter being of the cast-in-concrete type, also supplied by the B.T.H. Co. Electrical surge arresters are provided on two sections of the bus-bars.

Turning to the boiler house, which is situated between and parallel with the two turbo-houses, 10 new boilers have been installed during the war, bringing the total up to 24. Of the B. & W. boilers, two are rated at 17,000 lb. per hour and six at 21,000 lb. per hour, while the remaining two are by Messrs. Clarke, Chapman & Co., Ltd. These are water-tube boilers having a heating surface of 8,800 sq. ft., and are each capable of evaporating 40,000 lb. of water, actual, per hour. They are fitted with the firm's "Woodeson" patent superheaters, forming integral parts of the boilers, and with "Bennis" inclined chain-grate stokers.

Six of the boilers supplied by Messrs. Babcock & Wilcox, Ltd., are of the patent water-tube land type, each having 6,182 sq. ft. of heating surface; each boiler is fitted with an integral superheater, and two 5 ft. by 14 ft. mechanical chain-grate stokers. The working pressure is 200 lb. per sq. in., and the steam is superheated 200° F. At the back of each boiler on the ground level, an economiser, having 200 pipes, by Messrs. E. Green & Son, Ltd., is fitted. To work in conjunction with each pair of boilers, independent draught plant is provided, comprising a motor-driven centrifugal cased fan, and a short steel-stayed chimney 60 ft. high. The "Sirocco" fans are arranged with up-cast discharge, and the chimneys are supported on gantries immediately over the fan-discharge connections.

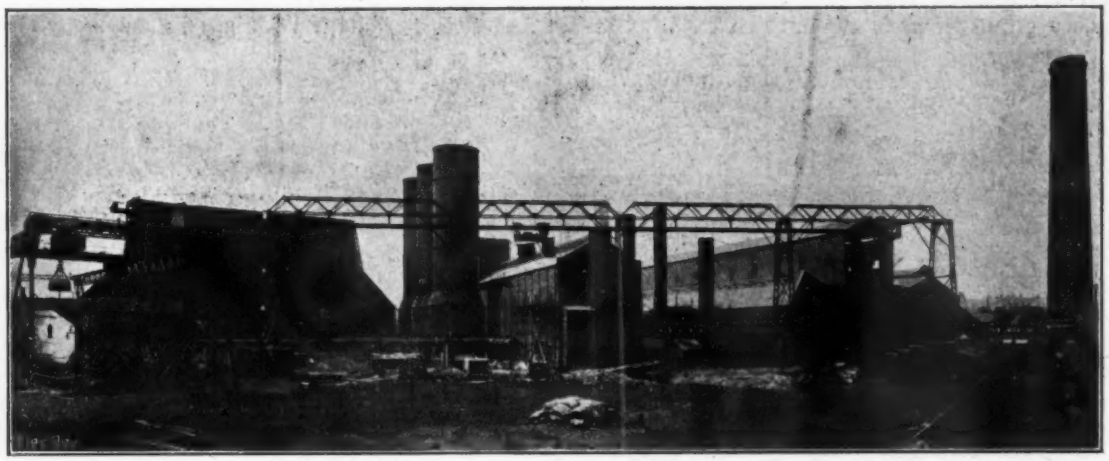


Fig. 3.—Exterior View of Power Station at Smethwick.

The boilers and economisers are set in brickwork, and to deal with the ashes there is provided an underground ash tunnel, the ashes being discharged into hoppers, which, in their turn, discharge into trucks running on rails in the tunnel. This arrangement is to be abandoned in favour of suction ash-handling plant, by Messrs. Edward Bennis & Co., Ltd., which is in course of erection.

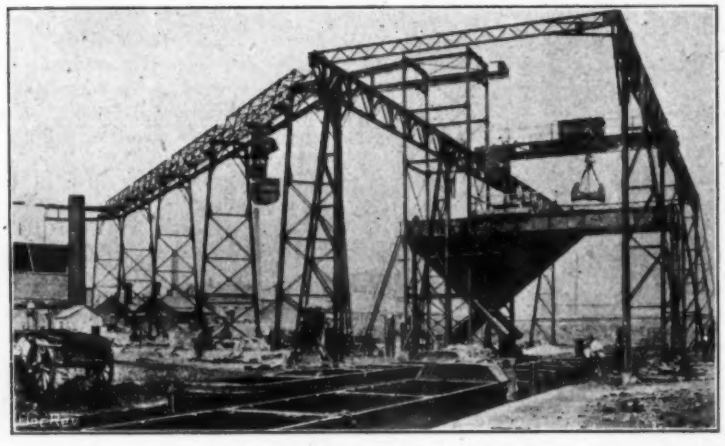


Fig. 4.—Coal-Handling Plant at Smethwick.

The stokers are suitably arranged for the application of balanced draught, and Messrs. Babcock & Wilcox, Ltd., have supplied two centrifugal cased fans, discharging the air into ducts, built of brickwork and running underneath the firing floor, from which branch connections are taken to the stokers under each boiler. Each boiler, when working in conjunction with its stoker, economiser, and induced-draught plant, is capable of evaporating 25,000 lb. of water per hour when burning good-quality coal, without balanced draught, the balanced undergrate draught being only brought into operation when burning low-grade fuel. The firing floor is on the ground level, the 10 new boilers being ranged on one side and the 14 original ones on the other side of the boiler house. These latter have flues at each end, with the damper in the middle. At the base of each stack, an economiser, by Messrs. Green & Son, Ltd., is provided, which consists of 320 tubes, arranged in two separate units of 160 tubes each, the vertical tubes being 11½ ft. in length. The economisers are arranged 10 tubes in width, and are suitable for a boiler pressure of 200 lb. per sq. in. The scrapers are driven by an electric motor with worm reducing gear. A new induced-draught fan is to be installed to correspond with the one provided at the opposite end.

Water softening plant, capable of dealing with 3,600 gallons of water, is provided, whilst the additions to the pump room comprise a five-stage boiler feed-pump of a normal capacity of 200 gallons per minute, against a total head of 500 ft., by Messrs. Mather & Platt, Ltd. It is driven by a 52-B.H.P. wound-rotor motor through a flexible coupling. Besides a 3,000-gallon reciprocating and two 7,000-gallon turbo feed pumps, Messrs. G. & J. Weir, Ltd., have supplied two rotary feed pumps. The first, a turbo-driven rotary, is capable of delivering 16,000 gallons of water per hour, against a pressure of 220 lb. per sq. in., when supplied with steam at a pressure of 155 lb. per sq. in., the steam being superheated 125° F. The second pump is capable of delivering 8,000 gallons per hour under the same conditions as the first. Hydrokineter nozzle heaters were supplied with both these pumps.

To deal with the cooling water two "Premier" wooden natural-draught chimney cooling towers were erected. Both towers are 70 ft. high; one occupies a ground space of 40 ft. by 144 ft., and will deal with 480,000 gallons of water per hour, cooling the same from 100° F. down to 80° F., with an air temperature of 55° F., and humidity of 75 per cent. The second tower occupies a ground space of 40 ft. by 122 ft., and can deal with 372,000 gallons per hour, cooling from 95° F. down to 80° F. These are in addition to the three natural-draught steel cooling towers supplied complete and erected by Worthington-Simpson, Ltd.; each tower having a shell 28 ft. 8 in. in diameter, chimney 22 ft. 8 in. in diameter, and an annular shell 6 ft. in diameter, with a total height above ground level of 98 ft. The latter three combined are capable of dealing with 500,000 gallons of water per hour, reducing the temperature from 100° F. to 80° F. based upon a wet bulb reading of 50° F. An idea of the cooling towers can be gained from fig. 3.

At Smethwick, during the busy war period, the amount of coal that was handled per day, reached something like 400 to 500 tons. With the increased capacity of the station, additional coaling plant had to be provided, and the extensions, including bunkers of 3,000 tons capacity over the boilers, now enable 40 tons of coal per hour to be dealt with. The coal-handling plant is shown in fig. 4. Two electrically-driven cranes by Messrs. Thos. Broadbent & Sons, of Huddersfield, and Holt & Willetts, of Cradley Heath, now span the canal, and by means of 15-cwt. grabs are capable of unloading one 30-ton barge per hour. From the barges the coal is discharged into an overhead bunker, which automatically feeds the electric telphers supplied by Messrs. Strachan & Henshaw, Ltd., of Bristol, and Priestman

Fig. 5.—Electric Truck.

Bros., Ltd., of Hull. The telphers run in at one end of the boiler house, and have an extension out at the further end, so that, if required, coal may be fed into the bunkers from both ends of the boiler house at the same time.

In fig. 5 is illustrated the central station use of electric trucks, or, in other words, practising what it preaches, such usage being prompted, and justified, by efficient, economic, and dependable operation—not sentiment.

In conclusion, we have to thank Mr. G. T. H. Legge, chief engineer, for permission to publish the above particulars and photographs, and the station superintendent at Smethwick, for affording facilities to gather the data at the time of our visit.

ELECTRICITY IN MINES.

We are glad to see from the report of the Chief Inspector of Mines for the year 1917, that the use of electricity is rapidly extending. The following table is interesting as showing the extent of the increase :—

	1916.	1917.
Surface.—Horse-power	368,446	391,744
Per cent. increase on preceding year ...	9·63	6·32
Underground.—Horse-power	482,216	521,896
Per cent. increase on preceding year ...	2·90	8·23
Total.—Horse-power	850,662	913,640
Per cent. increase on preceding year ...	5·71	7·40

whilst the table below shows the aggregate horse-power in the different Inspection Divisions :—

Division.	Surface.	Underground.	Total.
Scotland...	38,463	135,668	174,131
Northern	103,507	110,469	213,976
York. & North Midland	91,393	75,788	167,181
Lancashire, North Wales, and Ireland	20,376	29,502	49,878
South Wales	121,587	123,175	244,762
Midland and Southern	16,418	47,294	63,712
Total	391,744	521,896	913,640

The number of electrically-driven coal-cutting machines in use at the end of 1917 was 1,739, an increase of 149 over the preceding year.

There were six fatal accidents due to the use of electricity, four of which took place on the surface and two underground. However unfortunate these accidents are, it is satisfactory to note that, so far as underground accidents are concerned, they appear to be decreasing, as the following figures, which give the number of fatal accidents since 1907, show :—1907, 10 ; 1908, 12 ; 1909, 13 ; 1910, 15 ; 1911, 9 ; 1912, 7 ; 1913, 13 ; 1914, 4 ; 1915, 8 ; 1916, 4 ; 1917, 2.

As regards the accidents themselves, the particulars are set out below.

It is somewhat difficult to comment on these accidents, as one can always be wise after the event, but they show, as has been pointed out in these columns so frequently how careful everyone should be when working with electrical plant, and again they show the absolute necessity of paying particular attention to the "earth" wire.

In regard to coal-cutting machinery, there were 678 collieries where coal-cutting machines were at work in 1917, as against 660 in 1916. The total number of machines was 3,799, as against 3,459 in 1916. 1,739 were worked by electricity, and 2,060 by compressed air. The total amount of coal won by these machines was 28,196,486 tons, this being an increase of 1,391,088 tons over the preceding year. 50 per cent. of the total number of machines are in two divisions, namely, Scotland and the York. and North Midland.

The following table shows the number of machines at work in the different divisions, and the quantity of coal obtained :—

Division.	No. of collieries where machines are at work.	No. of machines.	Worked by		Mineral obtained.	No. of conveyors at coal face.
			Electricity.	Compressed air.		
					Tons.	
Scotland... ...	234	1,039	893	146	9,841,098	102
Northern ...	89	750	145	605	3,784,051	75
York. and North Midland ...	132	879	425	454	8,354,159	138
Lanc., N. Wales and Ireland ...	98	620	55	565	2,796,388	45
South Wales ...	55	159	69	90	718,314	205
Mid. and Southern	70	352	152	200	2,702,476	38
Total in 1917 ...	678	3,799	1,739	2,060	28,196,486	603
Total in preceding year ...	660	3,459	1,590	1,869	26,805,398	491

whilst the next table shows the type of machine, and the number in use at work in the different divisions. It will be noticed that of the compressed air machines more than half were of the "percussive" type.

Kind of machine.	Scotland.	Northern.	York. and North Midland.	Lancashire, N. Wales, and Ireland.	South Wales.	Midland and Southern.	Total.
Driven by electricity :—							
Disk	590	46	157	10	3	36	842
Bar	261	25	90	24	30	26	456
Chain	36	72	171	21	36	90	426
Percussive	2	—	1	—	—	—	3
Rotary heading	4	2	6	—	—	—	12
Total	893	145	425	55	69	152	1,739
Driven by compressed air :—							
Disk	97	40	130	116	2	14	399
Bar	7	17	49	54	18	5	150
Chain	2	26	123	48	40	57	296
Percussive	39	522	150	345	30	120	1,206
Rotary heading	1	—	2	2	—	4	9
Total	146	605	454	565	90	200	2,060
Total in 1917	1,039	750	879	620	159	352	3,799
Total in preceding year	987	671	802	569	136	294	3,459

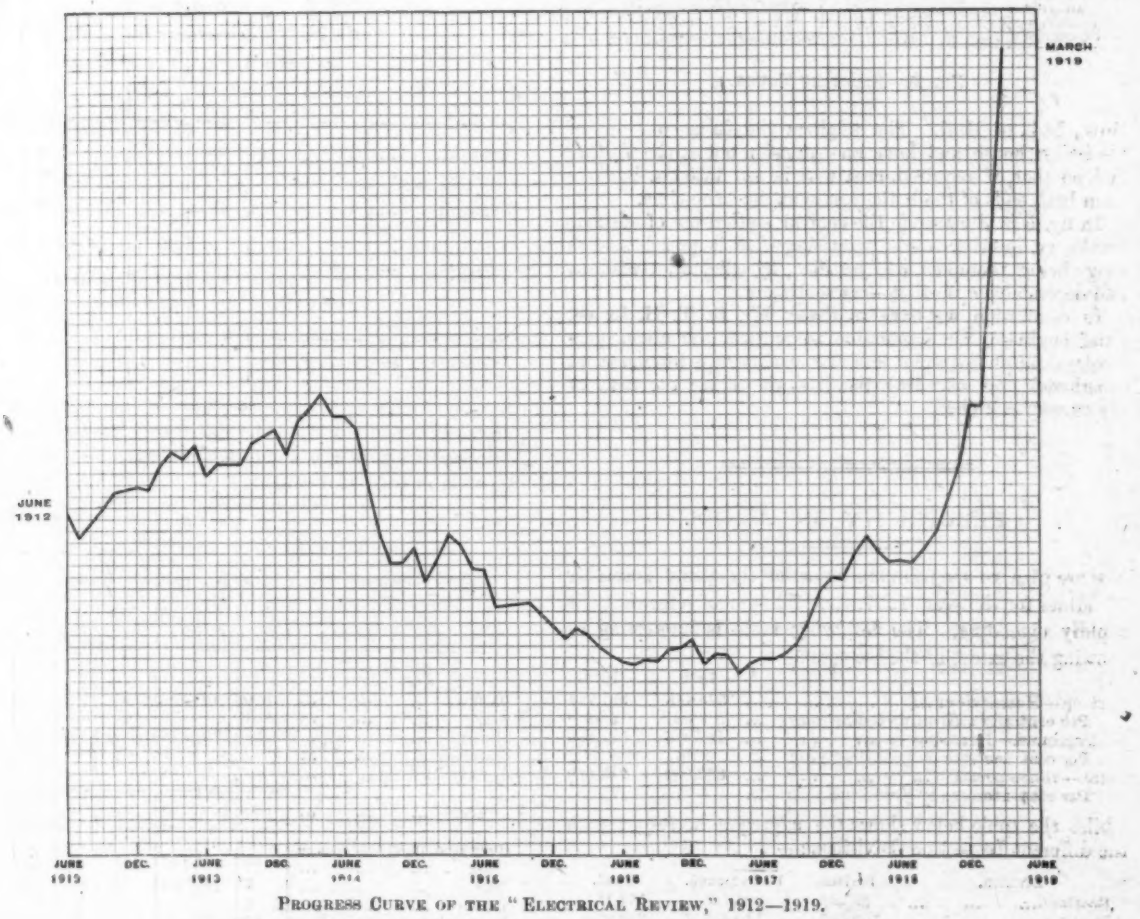
The table below is interesting, inasmuch as it shows the quantity of mineral cut by the machinery in the various inspection divisions.

In regard to safety lamps, the report says :—It is worthy of note that the increase in the use of electric safety lamps is very marked, thus :—The numbers in use were in 1911, 4,298 ; 1912, 10,727 ; 1913, 37,823 ; 1914, 75,707 ; 1915, 95,167 ; 1916, 126,784 ; 1917, 146,651. The total number of oil safety lamps in use in 1917 was 600,919, the total in 1916 being 610,821 ; so that the electric lamp would appear to be displacing the oil lamp to some extent. The majority of the electric lamps were used in the York. and North Midland and South Wales Divisions, there being 65,285 in the former and 58,630 in the latter.

Division.	Statute tons cut by electricity.					Statute tons cut by compressed air.					Total quantity of mineral cut by machinery.
	Coal.	Fire clay.	Iron stone.	Oil shale.	Total.	Coal.	Fire clay.	Ganister.	Iron stone.	Total.	
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Scotland	8,861,385	29,689	84,835	6,549	8,982,458	842,173	210	—	16,257	858,640	9,841,098
Northern	1,152,047	—	—	—	1,152,047	2,631,105	899	—	—	2,632,004	3,784,051
York. and North Midland	4,184,359	—	—	—	4,184,359	4,145,498	23,769	533	—	4,169,800	8,354,159
Lancashire, North Wales, Ireland ...	386,206	—	—	—	386,206	2,410,182	—	—	—	2,410,182	2,796,388
South Wales... ...	305,474	—	—	—	305,474	412,840	—	—	—	412,840	718,314
Midland & Southern	1,191,563	26	372,177	—	1,563,766	1,103,466	1,620	—	33,624	1,138,710	2,702,476
Total in 1917 ...	16,081,034	29,715	457.012	6,549	16,574,310	11,545,264	26,498	533	49,818	11,622,176	28,196,486
Total in preceding year	15,507,311	3,924	403,272	8,096	15,922,603	10,795,799	25,142	13,547	48,307	10,882,795	26,805,398

THE "ELECTRICAL REVIEW" AND THE WAR.

"How did the war affect your business?"—The question is a familiar one to very many of our readers, as it is to ourselves ; and we think that a few particulars of our experiences during the great upheaval may be of interest.



Progress Curve of the "Electrical Review," 1912—1919.
The curve is drawn to scale, but the lower portion of the diagram is omitted.

Naturally, the first effect of the outbreak of war was to put the brake on business generally, and on the manufacturing industries in particular ; the technical Press is very sensitive to fluctuations in trade, and whereas up to that time the circulation of the Electrical Review had been steadily advancing, a marked drop occurred during the first three months of the war. We give herewith a diagram showing the monthly averages of the "paid circulation" of the Review during the past six years—that is, the net paid circulation, exclusive of all exchanges, voucher copies, &c.—which shows this sudden drop, as well as other interesting features ; it will be noticed that in

normal times there is a rapid rise during the autumn and winter, and a slight decline during the summer months, which in 1914 was greatly magnified by the disaster which then overtook the nation. In the early months of 1915 there was the usual recovery, but the failure of the Allies to turn the tide of battle was reflected in the almost continuous decline throughout the remainder of that year, and in 1916 almost the lowest ebb was reached, though the total was still comparatively high for a technical journal of its class. That year, however, was marked by the Battle of Jutland, the Battle of the Somme, and successful efforts on the part of all the chief Allied Armies—it was the year of the turn of the tide, and though the usual valleys occurred in the progress curve of the Electrical Review, the upward trend was plainly shown in the autumn and winter of 1916 and 1917. From the summer of 1917, in fact, we have never looked back; the customary fall in the summer of 1918—increased hardly at all by the spring offensive of the enemy—was stayed in June and reversed in August, when the fortune of War had definitely changed in favour of the Allies. From July, 1918, to the present time the rise in our paid circulation, undoubtedly reflecting the confidence of the electrical industry in the future course of events, has been phenomenal; it is interesting to note that our steady point in that year was identical with our lowest point in 1914, and in January this year we had practically equalled our highest point in 1914. The extraordinary steepness of the curve in 1919 is very striking, and, to our mind, is indicative of the coming boom in the electrical industries; it is embarrassing, also, for until lately the stringency in the paper market has been a heavy handicap upon our aims. However, the situation is improving, though it is still very far from pre-war price conditions, which are not likely to return.

Of the staff of the Electrical Review, 25 took an active part in the war, of whom Riflemen H. Allen and W. H. Beck gave their lives for their country, while six, of whom several were severely wounded, were invalided out of the Army; others have been welcomed back to their old posts, but some are still on active service.

While the aerial bombardments of the City fortunately failed to find the editorial, publishing, or composing rooms of the Electrical Review, in 1917 the works of our printers were struck by a bomb, and for a time the production of the journal was seriously jeopardised.

During the war we have had pleasure in supplying the Electrical Review, free of charge, to all technical men on active service who chose to avail themselves of our offer, and we are very glad to know, as letters that we have published have shown, that this service has been keenly appreciated by the recipients and their comrades. We have also been consulted on very many occasions by Government Departments in need of information on technical, commercial, topographical, and other matters, and we have been happy to place at their disposal all the resources at our command. On the other hand, we have been subject to restrictions with regard to the publication of items of news and technical articles, which at times have been exceedingly irksome, especially because we were not permitted to inform our readers why these items did not appear in our pages, although they were practically common knowledge. In fact, some articles which we submitted for censorship were denied publication in our pages, although they were published by contemporary journals which did not submit them to the censor. We were informed that whether others published such information or not, it was particularly desirable that they should not appear in the Electrical Review, which was closely scanned by the agents of our enemies.

Oil from Cannel Coal.—A Committee, appointed by the Council of the Institution of Petroleum Technologists, to investigate the production of oil from cannel coal and allied minerals, issued an interim report last summer recommending that an experimental station should be established for tests on retorts and material; as an outcome of the report, the Midland Coal Products Co., Ltd., has been formed, with a subscribed capital of £100,000, for the production of oil and the manufacture of fuel, &c. A site has been acquired in the centre of the Midland coalfield, with excellent facilities for obtaining coal and establishing the industry on a sound commercial basis.

THE BRITISH ELECTRICAL AND ALLIED MANUFACTURERS' ASSOCIATION.

Annual Report and Meeting.

The annual general meeting of this Association was held at the offices, 36, Kingsway, London, W.C. 2, on March 20th, Mr. F. R. Davenport, Chairman of the Council, presiding.

Mr. Davenport, in moving the adoption of the annual report (referred to below) reviewed the war period generally, recalling the heavy sacrifices, personal as well as financial, which were made in order to secure a permanent peace. He dealt with the many transition questions which would continue to confront the electrical and allied industries before a resumption of normal business could be expected, of which the chief were labour, the export trade, and the much-debated question of the future fiscal policy of the Government.

The accounts and report were adopted.

The Chairman announced the result of the election to the five vacancies on the Council as follows:—British Westinghouse Electric & Manufacturing Co., Ltd., D.P. Battery Co., Ltd., Electromotors, Ltd., Lancashire Dynamo & Motor Co., Ltd., and Nalder Bros. & Thompson, Ltd.

Messrs. Price, Waterhouse & Co. were re-elected auditors of the Association for the year.

During the course of the proceedings the Chairman said that it was with great personal regret that he judged it necessary to resign the office of chairman, which, owing entirely to their goodwill, it has been his privilege to hold for five consecutive years. He was led to that resolve solely by the fact that he had held the chairmanship so long, and by the expediency, in most undertakings, after such a period, for making way for someone else. He had the great satisfaction of knowing that his successor, whoever he might be, would find himself in charge of a real live organisation with a loyal and energetic staff equal to any call made upon them. There was no reason to anticipate anything but greater successes still for the Association in the future, and he hoped to continue in close touch with all its work. In conclusion, he thanked the members for their courtesy to him on all occasions and the staff for their loyal service. His relations with everyone had been, he was happy to say, of the most cordial kind.

Mr. C. P. Martin (C. A. Parsons & Co., Ltd.) and Mr. John Taylor, O.B.E. (Mather & Platt, Ltd.), in respectively proposing and seconding a vote of thanks to the Chairman for presiding, spoke of the great regret with which they had all heard of his determination to vacate the chair. He had been in every way an ideal chairman, doing a tremendous amount of work, and extending to all comers the greatest consideration and courtesy.

The vote of thanks having been passed with acclamation, the proceedings terminated.

At the subsequent meeting of the Council of the Association, Mr. W. O. Smith, managing director of Elliott Bros. (London), Ltd., was unanimously elected chairman for the year 1919.

The report of the Council covered the financial year ended September 30th, 1918. After four years of war, and in the eighth year of its operations under the title of the B.E.A.M.A., the Association was found to be firmly established as the representative of the electrical and allied industries.

The prospect, when once the problems of reconstruction had been overcome, were distinctly promising in view of the increasing importance with which electrical power as an aid to industrial development was now regarded; the immense amount of future work connected with reparation; and the developments which had been held up during the last four years.

The one matter that appeared to give rise to anxiety now was how to secure that full use was now made of the capacity which was created and thoroughly tested during the war—how to secure full workshops, especially for export trade. Much of the recent work done by the Export Committee arose directly out of war conditions. Rations of metals were obtained by the Association in quarterly instalments for a variety of manufactures, thus permitting members not only to keep in touch with their overseas connections, but to enter markets which were very largely in the hands of Germans in pre-war days. The signing of the Armistice was followed by the gradual relaxation of export and import restrictions, but it was still necessary for members to take into consideration contracts in hand which bear priority classification, and to quote deliveries subject to non-interference by priority. This placed the foreign manufacturer in a position of advantage; but the recent conference with the Standing Council for Post-War Priority would, it was believed, have the effect of shortly removing all such restrictions tending to retard home and overseas trade.

The lack of status of H.M. Trade Commissioners in the Dominions, after being the subject of correspondence with the Government Departments concerned, was now the subject of a vigorous protest by the Council to the Chairman of the War Cabinet, from which results were expected.

Advantage had been taken of visits of members of Overseas Committees, *e.g.*, South Africa and the Argentine, to discuss with them not only the work of their respective committees, but also to post them with information as to the activities and method of working of the Association at home. Reports since received from the Overseas Committees showed that these conferences had been advantageous. The South Africa Committee had, in important contracts, been able to bring into agreement on conditions not only British tenderers, but also those representing important Swiss firms.

Useful reports had been received from the Argentine Committee, which had not been so much affected by the war as those in Africa and India, many members of which had been engaged on Government service arising out of the war. This Committee had been active in reporting as to enemy firms; arising out of which the Department of Overseas Trade had recently increased the number of Commercial Attachés and representatives in South America, and a further increase was now under consideration.

The Australian Overseas Committee had been active in the matter of import duties, and at important interviews it was strongly urged that the basis of assessment should be altered from *ad valorem* to weight in the case of dynamos and motors, and to a unit basis in the case of incandescent lamps, and that, particularly in the case of heavy machinery which required time for its manufacture, the duty should be based on the cost at the time of contract rather than at the time of shipment. This Committee had also under consideration the adoption of a standard declaration form for use in the Dominions. They had, further, secured amendment of Government conditions of contract in favour of British manufacturers. Practically all the Overseas Committees, more particularly those in overseas Dominions, had reported on certain practices of Japanese manufacturers with regard to British trade marks and labels. These matters had been taken up with the Board of Trade. Acting on the suggestion of the Department of Overseas Trade, all members of the Association were warned to make careful inquiry before sending information to certain Swiss inquiries, many of these being either recently naturalised Germans or seekers of information in the interests of German or Austrian houses. The Association had published an interesting report on the electrical trade of Brazil by Mr. John Glen, the representative in Rio de Janeiro of Messrs. Mather & Platt, Ltd., and the Association's correspondent for Brazil, in collaboration with the Argentine Overseas Committee.

The director of the Association recently visited the Scandinavian countries with a view to studying the commercial and industrial conditions at present subsisting there.

The staff of the Association had been strengthened as from January 1st, 1919, by the engagement of Mr. I. V. Robinson, for many years a leading member of the staff of Messrs. Richardsons, Westgarth & Co., Ltd.

The proposed new Trade Classification of Imports and Exports was deferred by the Board of Trade while the war was in progress. The Association's Committee had recently had a conference with the Statistical Department of the Board, and there was now a promise of rapid progress.

The Council was in communication with the Restriction of Imports Department of the Board of Trade as to the necessity for continuing the war import restrictions on a variety of electrical apparatus, *e.g.*, instruments, accessories, heating and cooking apparatus, and dry batteries. The Council takes the view that none of the existing restrictions should be removed at present, but that each application for permission to import should be considered, as heretofore, on its merits, leave not to be granted without the fullest inquiry. The Association has for some time exercised a Government licence controlling the import of supplies of essential accessories, and it is possible that the present negotiations will result in the Association's becoming the general licensing authority for the whole trade, thus reasonably controlling imports in accordance with proved necessity.

It is believed that the report of the Ministry of Reconstruction Engineering Trades (New Industries) Committee will be a weighty factor in shaping the future industrial and fiscal policy of the country.

In regard to the super-power stations scheme, whilst agreeing generally with the recommendations embodied in the Board of Trade Report, the Council expressed the opinion that the Commissioners proposed to be appointed should act in the first instance as an advisory body without compulsory powers; and that it was of the highest importance that pressures, periodicities, and methods of supply generally should be standardised and everything practicable done to improve the economy of generation and distribution, and to free the industry from all legislative restrictions which retard its development, make it unattractive to investors, and adversely affect the other industries which depend for their development on a cheap supply of power.

By request, the Council agreed to send representation to the Salvage Department of the Ministry of Munitions to consider as to the best means of disposing of those portions of unconsumed war stores which are of interest to members.

The Ministry of Munitions adopted a proposal of the Council that for the better adjustment of contract prices, necessitated by Government wages awards, there should be a general percentage basis for all contracts (instead of innumerable individual settlements on the merits of each case). The system adopted was put into force during the year, worked well, and was, later, adopted by the Air Ministry. The Admiralty, still later, adopted it, but with its usual reservations. The Post Office has accepted settlements on the same basis. The Council was in active argument during the year with the Admiralty over its arbitrary methods of determining the price to be paid for apparatus. A promise of amendment was extracted, but little improvement has been noticed, and, as a result, certain Sections of the Association resolved not to quote to Admiralty inquiries until the promise was fulfilled.

A movement was set on foot by the Institution of Electrical Engineers during the war for combining in one association all electrical interests for the purpose, mainly, of educating the public in the uses of electricity by the widest publicity. The Council has promised support to the movement, subject to its winning from the other public bodies interested support corresponding to the aims of the association which it is proposed to incorporate under the title of the Electrical Development Association.

The Council sent representatives to the Joint Committee set up by the Institution of Electrical Engineers to consider and report as to the creation of a national proving house for the electrical industry. The Committee has not yet found itself able to make recommendations.

The Council accepted from the Board of Agriculture a seat on the Electroculture Committee set up for the purpose of study and experiment in the best methods of equipping farms for electroculture.

The report contains brief reference to national kitchens, the Electricity Supply Order, 1918, the F.B.I. Railway Bill, education, and progress made with research for the improvement of, and the preparation of standard specifications for, insulating materials, viz., ebonite, composite materials (vulcanised and unvulcanised), magneto distributor material, mica, insulating papers, varnished cloth, and enamelled wire; also other departments of research activity.

Representation has been established on the Technical Co-operation Committees of the Institution of Electrical Engineers, and in the conferences arranged by that Institution, to discuss the metric system and the proposals for a national proving house.

The Industrial Solicitor reports that purchasers on the whole are now found willing to accept the text of the I.E.E. General Conditions. A special set of conditions, governing contracts including erection, was settled between the Council and the Port of London Authority, and members were instructed to tender to the Authority upon that set. For P.L.A. contracts without erection, Conditions of Sale (A) are still in force. The Revising Committee prepared a new edition (third) of the home Conditions of Sale known as (A) and (B), which was issued during the year.

The texts of the Association's export Conditions of Sale known as (AE), (BE) and (AEC) have been revised during the year, and their translation into French, Spanish, and Russian directed.

The Council considered it expedient to become a member of the Association of Great Britain and France (president, Lord Denbigh), the main object of which is to constitute a permanent link between the industrial communities of the two countries.

The following new Sections were constituted during the year: The Portable Accumulator, the Primary Battery, the Insulations, and the Centrifugal Pump Sections.

The question of finding larger accommodation for the rapidly increasing business and staff of the Association has once more been before the Council during the Session, and it is hoped shortly to make an announcement to members.

The number of members on the register at the end of the year (December 31st) was 216. Forty-five firms were admitted to membership during the year, and three resigned.

The system of tendering embodied in cross-tendering agreements continues to find favour among members, but has not been extended during the year. The Association has in operation the following such agreements: (1) Steam engine builders and dynamo makers; (2) Diesel-engine builders and dynamo-makers; (3) condenser makers, steam-engine builders, and turbine makers.

A 60,000-kw. Transformer.—A static transformer of this capacity has been supplied by a German firm to a Rhineland electricity works. The pressure is stepped up to 110,000 volts from four 6,250-volt primary coils. The complete transformer weighs 116 tons, the core 66 tons, the casing 15 tons, and the insulating oil 35 tons. The overall height is 17 ft. 3 in., and the floor space occupied 18 ft. × 8 ft. 4 in. The four L.T. coils at 6,250 volts are normally connected in parallel, but may be placed in series to work at a primary pressure of 25,000 volts. The transformer is insulated with material specially manufactured by the makers for H.T. purposes. Tests showed a loss of 126 KW. in the iron core, and 434 KW. by radiation from the aluminium coil: a total loss of 560 KW., which corresponds to an overall efficiency of 99·07 per cent. A second transformer of the same size is nearly completed, and will, together with the first one, be connected to two turbo-generator sets, each of 50,000 KW.—*Zeitschrift des Vereines Deutscher Ingenieure.*

LEGAL.

MEAGHER & HAYES *v.* CITY OF CORK TRAMWAY AND ELECTRIC LIGHTING CO., LTD.

AT the Cork Spring Assizes, on Saturday last, before Lord Justice O'Connor and a jury, this action was heard, in which plaintiffs claimed £109 for overcharges by the defendant company in the supply of electric power to plaintiffs' works at Crosse's Green, Cork. The defendant company's case was that the circumstances entitled them to make the charges, and that these charges were regular.

Plaintiffs' case was that they were charged for electrical energy supplied by the defendant company at 1½d. per unit for the first 1,000 units, 1¼d. for the second, and 1d. for the third. They claimed to be entitled to a flat rate of 1d. per unit, at which rate energy was supplied by the defendant company to a neighbouring sawmill owned by a Mr. Harte. They maintained that there were no special clauses in the agreement between the defendant company and Harte to justify any special tariff, but that the supply was for the same purpose—a sawmill—and during the same hours, and that their consumption and that by Harte was approximately the same.

The defendant company contended that plaintiffs were builders and contractors, and that the sawmill they had erected for war work was only an auxiliary business. The problem the defendant company had to solve was to keep consumers off "the peak of the load." It was then quite economical for the defendant company, and advantageous to give special tariffs to consumers who would accept current at hours off the peak. Mr. Harte was supplied on such terms, and the defendant company had the option of cutting off his supply without notice during those hours.

MR. NALDER, manager of the defendant company, said that plaintiffs could have had the same terms as Mr. Harte on the same conditions without any question. The arrangement with Harte was not the result of an offer by the defendant company; it was negotiated on Harte's behalf.

MR. FITZGIBBON: You wrote a letter in answer to the plaintiffs' claim for the 1d. rate that "current at 1d. per unit is only given to consumers consuming at least twice as much as you do." Is that correct?—I think so.

The statement in the letter is a lie. It is not true?—I would not say that.

The JUDGE: Have you in existence a single written agreement undertaking to supply current at 1d. per unit to persons willing to have it closed down during "the peak of the load" hours? That is an agreement similar to the one you have with Harte?—We have. I could not give names off-hand.

The JUDGE intimated that a list of the kind should be prepared for the jury.

MR. FITZGIBBON (to Witness): Did you go to Mr. Harte on January 9th last and tell him that he should sign an agreement?—He never signed an agreement.

Witness was then cross-examined as to accounts supplied to plaintiffs, which showed charges of 1d. per unit, which counsel suggested were made after the issue of the writ in the present action, and charges of 2d. per unit to plaintiffs' premises in Travers Street. Witness objected to be examined on accounts, as he was not conversant with them.

The JUDGE questioned witness as to the offer made to the plaintiffs, and pointed out that the agreement mentioned was much more stringent than the terms which Harte had.

WITNESS: We never had it in mind to give them any other than the terms given Harte—the right to cut off during "the peak of the load" hours. It was not a case of picking out one or two special customers, and making hole-and-corner agreements.

The JUDGE thought that the case might be settled. If the jury came to the conclusion that there were hole-and-corner agreements they should find for the plaintiffs.

The Court adjourned for half an hour, and on its reassembling MR. SERJEANT SULLIVAN said that Mr. Nalder had the information asked for by the Judge.

MR. NALDER stated the special terms which they gave customers, and produced the figures.

MR. SERJT. SULLIVAN then said that the parties in the action had consented to a dismiss. Certainly there was a misunderstanding in the letter written to the plaintiffs, who had not, apparently, a fair chance of considering whether or not they would come in on these special terms. The defendant company had undertaken to pay a certain sum for costs; the plaintiffs would come in on the penny rate, and the accounts would be settled on that basis.

The JUDGE said that the arrangement was very satisfactory. In agreeing to pay certain costs of plaintiffs, the defendant company had acted handsomely. Plaintiffs, through the incorrect phrasing of a letter, did not get an opportunity they might have availed themselves of.

The action was accordingly dismissed.

Summer Time.—An amendment to repeal the Daylight Saving Act was attached to another Bill, which was not passed by Congress before the adjournment early last month. The daylight-saving law, therefore, remains in force in the U.S.A.

Through an error in the announcements in the daily Press, which was not corrected in time for our last issue, we were misled as to the date of the change in this country. We trust that our readers suffered no inconvenience through the mistake.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Re-Settlement of Officers.

Your article under the above heading, published January 24th, and the following correspondence, has been of great interest to me. Although in accordance with the views expressed in their supplementary article of March 14th by EDS. ELEC. REV., I must also admit to a sneaking admiration for "Fed-Up's" spirited criticism of the whole affair.

What, may I ask, is being done for the man who, although not one of the "wealthy men or men of position," has, by virtue of his personal determination and ambition, raised his general educational standard and knowledge of his profession, to a level not attained by many of the "officer type"?

Has he no right, after doing his share of the fighting, to the benefits of further tuition, &c., which this scheme offers, because, for a variety of reasons, he does not hold the King's Commission?

Or must he, while his share in taxation for expenses incurred by the Resettlement Committee is being paid, have again to rely on his sorely tried determination to "get there"?

Belgium, *March 26th*, 1919. **Gunner.**

[Once more we point out that this scheme, though explained in a pamphlet *entitled* "The Re-settlement of Officers," is explicitly, clearly, and unmistakably provided for *all* men, whether officers or in the ranks, whose educational qualifications justify their being trained for responsible posts in civil employment. *This scheme is not confined to officers at all.* As we said in our issue of March 14th, it is for men of the "*officer type*," not for *officers only*; for "a large proportion of the N.C.O.'s and men." "Gunner" has nothing to grouse about; he should simply write to the "Appointments Board, Ministry of Labour, London, S.W." for Army Form Z15—his actual rank is immaterial.—EDS. ELEC. REV.]

In sympathy with "Ex-Sapper" and "Fed-Up," may I state that I strongly object to the remarks of him who was "Proud to hold a Commission"?

In the brigade section in which I served there were six fully-qualified engineers under the control of a non-technical clerk.

To do this section officer justice—he was a transfer from the infantry—he did put forward applications for commissions to Divisional H.Q. The O.C., however, was a schoolmaster, I believe, and was attached R.E. Applications had very little, if any, chance of passing his hands. The result was that one man who was a sergeant was allowed home for training after 18 months' waiting, while a sapper was granted an immediate commission on the strength of representations of his civil employers—a railway company.

Though many preferred certainty of a first-class sapper to possibility of a third-rate commissioned rank, the choice was not always there.

March 25th, 1919. **E. W. A.**

The Association of Officers and Staff Members of Electricity Companies (A.O.E.C.).

It has come to the knowledge of the Executive Committee that some misapprehension exists as to the reasons which led to the formation of this association.

There are a large number of men whose long and honourable service with the electricity (power and supply) companies constitutes an asset which is to them of great value. They see the prospect of amalgamation or absorption of the companies in the near future, whether under the scheme drawn up by the Board of Trade Committee or otherwise, and they fear that in the changes in organisation and readjustments of staffs which will probably take place the value of this asset may be reduced or even lost. This association has, therefore, been formed with the object of securing by concerted action the right to compensation for any one whose interests may be adversely affected—a right which in the case of the London water and dock companies was definitely assured by clauses in the Acts of Parliament authorising the formation of the Metropolitan Water Board and the Port of London Authority. Membership of the association is limited to those of not less than ten years' service, and it is very desirable that it shall be of the strongest representative character. It is not intended to compete with other associations having other interests, but in its object it invites the support of all grades of officers and staff members of the companies.

I would add that the Executive Committee has already placed the views of the association before the Board of Trade in connection with the Government Bill shortly to be brought before Parliament.

Oswald M. Andrews,
Hon. Secretary.

London, W., *March 29th*, 1919.

War Bonus Awards.

I shall esteem it a favour if you will allow me a little space to point out that the bonus of 20 per cent. on salaries, plus £90, is a decidedly better rate than the £1 8s. 6d., plus 12½ per cent. over bonus and wages. There is no point where these two rates become equal. The E.P.E.A. award leads all the way and all the while—no matter whether the wages or salaries be 30s. a week or whether they be £5 a week. If our trade union friends care to reckon out a dozen cases they will realise the truth of my statement.

John Vincent,
National Amalgamated Union of Engineemen, Firemen, &c.

Rotherham, *March 26th*, 1919.

Rotor Currents of Slip-ring Motors.

At one of the meetings of the I.E.E., held some time ago, a suggestion or ruling was passed to the effect that manufacturers of A.C. motors should state on the nameplate of the motor the full-load value of the rotor current (this, of course, applies to slip-ring rotors). So far, I have not come across any motor where this suggestion has been carried out, and I think that if the manufacturers would comply with this request a good deal of trouble would be saved in the way of burning-out of cables connected between the rotor and rotor starting switch. Very often the electrician simply installs cables for both stator and rotor of the same size, and if the size agreed on is large enough for the full stator current, but too small for the rotor current, the result is obvious. I have come across mistakes of this sort which could have been avoided by the rotor current being given on the name-plate.

If you will kindly bring this matter to the attention of manufacturers by inserting this letter in your valued paper, I shall be obliged.

Rotor.

March 29th, 1919.

Electricity Supply Commercial Association.

I should like to draw the attention of your readers to the advertisement which appears upon another page giving notice of a mass meeting of the above Association to be held at Caxton Hall, Westminster, on Thursday, April 10th, at 7 p.m. In addition to present members, a cordial invitation is extended to all those interested and eligible for membership of the Association. Your readers will doubtless be glad to know that widespread interest is now being taken in this Association, and following my previous letters published in the Review, hundreds of new members have joined. The Association affords a splendid opportunity for the commercial staffs of electricity supply undertakings to co-operate in an association of their own, which has amongst its objects, in addition to providing means for expression and exchange of opinion, such important matters as representation, protection, and consideration of Bills before Parliament so far as they may affect the interest of members. Those in the Greater London area who wish to avail themselves of this opportunity to associate and co-operate with their colleagues in electricity supply undertakings in all parts of the country should endeavour to be present at the meeting mentioned above. Members of provincial staffs interested should communicate with the following divisional branch secretaries:—

Midland (West): Headquarters, Birmingham; hon secretary, Mr. H. C. Taylor, City of Birmingham Electricity Department, 14, Dale End, Birmingham.

West Yorkshire: Headquarters, Dewsbury; hon secretary, Mr. C. B. Tresh, Yorkshire Electric Power Co., Wellington Road, Dewsbury.

Scottish: Headquarters, Edinburgh; hon secretary, Mr. J. Beveridge, 10, Henderson Row, Edinburgh.

North-Eastern: Headquarters, Newcastle-on-Tyne; hon. secretary, Mr. E. S. Pattison, Newcastle-on-Tyne Electricity Supply Co., Ltd., 11, Sydenham Terrace, Whitley Bay.

Lancashire: Headquarters, Liverpool; hon. secretary, Mr. H. G. Quillam, 29, Salisbury Road, Wavertree, Liverpool.

Midland (East): Headquarters, Derby; hon. secretary, H. R. Kinnerley, Electricity Works, 9, Iron Gate, Derby; or direct to me for further information.

G. R. Smith,
Acting Hon. General Secretary.

39, Leghorn Road, Plumstead, S.E.18,
April 1st, 1919.

The Transport Bill.—A White Paper has been issued summarising the powers and functions under statute which may be transferred from other departments to the Ministry of Ways and Communications. They include the powers of the Board of Trade with regard to tramways and light railways, those of the Light Railway Commissioners and the Development Commissioners, those of the Board of Trade with regard to electrical undertakings, and the functions of the Local Government Board with regard to loans for electricity works for the supply of electricity for traction.

BUSINESS NOTES.

Our Letters from the Forces.—A correspondent just demobilised from the R.A.F. writes:—

"I should like to express my very sincere thanks for the gift of the Electrical Review for such a long period. It will always be a pleasant memory to recall the practical way in which you kept the far-scattered electrical *personnel* in touch with everything affecting their interests at home. Many times I have known those not essentially electrical take an absorbing interest in the "leaders" of your journal, because they suited their case also. It is, perhaps, difficult to judge all at once of things at home on return after a lengthy period away, but it is to be hoped that some of the spade work you have been doing so long and so well will bring forth its just harvest. I have in mind 'The Export Vision' as one instance. Do the workers realise? Will they ever? For the sake of all that has been sacrificed during the war, let's hope they will realise, and, at the same time, learn to discriminate between leaders and fanatics. . . . .

"Wishing every success to your paper, which has been more than valuable over a long, long period, and once more—many thanks."

Another writer, also recently demobilised, says:—

"Thank you most heartily for the copies of the Electrical Review which you have so kindly sent to me while I have been in France. I have enjoyed it particularly during the past few months, when work has been anything but pressing."

British Orders for British Works.—The Executive of the Federation of British Industries, on March 26th, passed the following resolution:—

That every effort should be made by the Government to deal with purely British firms in preference to firms of alien origin; and that, in pursuance of the Government's policy, it is not sufficient for the Government to close down firms which are technically of enemy origin, but that it must set an example by placing its contracts exclusively with firms owned and controlled by British subjects.

Reconstruction Pamphlets.—The Ministry of Reconstruction has issued two more pamphlets. No. 18 describes the Whitley Scheme for Industrial Councils, and reviews the work that been accomplished in that connection. No. 19 deals with the State regulation of wages.

Auction Sale.—By order of the Disposal Board, Messrs. Simmons & Sons will sell by auction, on April 9th, at the Newbury Inspection Depôt 1,605. near Newbury Racecourse, a quantity of electrical material. For particulars see advertisement pages to-day.

Plant for Disposal.—Stoke-on-Trent Electricity Department invites offers for one 300-kw. D.C. Belliss & Morcom steam engine with E.C.C. dynamo, and three Babcock water-tube boilers.

Sheffield Corporation Tramways Department will have for disposal, in August or September next, 10 four-wheeled single-deck tramcars. See our advertisement pages to-day.

Profit-Sharing in Principle, but No Profits to Share.—At a commemoration held in the Krupp's Friedrichshalle on Sunday, February 23rd, the present director of the works, Herr Krupp von Bohlen, pointed out in a speech to the assembled guests that the external defeat and internal commotions had involved the Krupp undertaking in incalculable dangers. The disaster thus hanging over a great concern had, more than any other occurrence, made it clear to all that it was not so much the personal interest of the individual that was at stake as the existence and prosperity of the undertaking, with whose future continuance the fate of all its members was bound up. There was much talk nowadays of socialisation and profit-sharing. The idea of sharing profits among the officials and workers had, however, been for years realised at Krupp's under many forms. The speaker went on to say that the management, in grateful remembrance of the great efforts of the employés, had elaborated a plan that large sections of clerks, minor officials and workers should participate more directly than hitherto in the balance-sheets of the company. The present complexion of affairs, which could hardly indicate a prosperous balance, had put an end to this idea. The economic position would determine how far it was possible to return to the idea. The speaker hoped that Germany would justify her existence in the eyes of the world, and that German labour would once more enjoy its ancient prestige.—*D.A.Z.*, February 24th.

Cold-Blast Pig-Iron.—The Minister of Munitions gives notice that in consequence of an arrangement with the manufacturers, whereby certain existing subsidies payable on cold-blast pig-iron have been, or are to be withdrawn, he has authorised an advance of 11s. per ton in the maximum price, to take effect as from April 1st, 1919. This advance, added to the increase of 15s. which took effect on January 1st, raises the maximum price for home sales to £10 8s. 6d. per ton f.o.t. makers' works. The export price remains unchanged at £11 12s. 6d. per ton, but the export drawback is reduced by the amount of the increase in the home price.

Calendar Competition.—The Sun Electrical Co., Ltd., is offering a number of prizes, ranging from £5 5s. down to 5s., for sets of phrases suitable for the Sun desk memo calendars. Anybody interested can obtain a copy of the rules by applying to the company's Publicity Department at 57-59, Neal Street, Long Acre, W.C. 2.

B.T.H. Whist Drives.—By four whist drives the staff of the B.T.H. Co., at Rugby, have raised £60 for the B.T.H. Relief Fund and St. Dunstan's Hostel.

British Firms Only.—Southwark Board of Guardians has decided that in future no tenders be considered from other than British firms, and that all firms tendering be requested to state the names of the principals.

Exports to China.—The *London Gazette* for March 28th contains a further list of persons and bodies in China to whom exports may be consigned.

New French Company.—A new company has lately been formed in Paris with a capital of £40,000, and the title La Société d'Appareils de Transports et de Manutentions Electriques.

B.E.A.—The British Engineers' Association (Inc.) has issued pamphlet M 152 (24 pp.), containing particulars of its various trade groups and sections. E 1 class covers electrical plant, machinery and accessories; I 1, internal combustion engines; R 1, railway and tramway plant and material; S 1, scientific and industrial instruments; S 4, steam engines, turbines, and condensing plant: W 5, wire.

Industrial Housing.—A memorandum has been issued by the Local Government Board, which gives in detail the terms of financial assistance offered by the Government to public utility societies for housing purposes. The Housing Bill which has just been introduced, contains provisions for the necessary Parliamentary authority for the payment of assistance. Any *bonâ fide* public utility society whose objects include the provision of houses for the working classes, and which complies with the conditions laid down, may receive the Government assistance in respect of approved housing schemes. It is hoped that organised bodies of workpeople will join in the promotion of public utility societies on which their members will be duly represented. The Government's offer is expected also to appeal to employers of labour in town and country, who have a direct interest in seeing that persons employed by them are well housed near their work. The Local Government Board and their Housing Commissioners will be prepared to give any necessary advice in regard to the formation of a public utility society.

War Trade Department.—In accordance with an arrangement made some weeks ago, Lord Emmott and Sir Nathaniel Highmore, K.C.B., who have since its inception in February, 1915, been respectively Director and Secretary of the War Trade Department, have now resigned their posts. The Board of Trade is taking over the War Trade Department, and has appointed Sir Alexander King, K.C.B. (the former Secretary to the G.P.O.), as Controller.

44 Hours' Ballot.—The Federation of Engineering and Shipbuilding Trades, at a Conference held in London, last week, resolved to take a pooled ballot vote of the members of all the Societies in the Federation on the question of applying for a 44-hour week. Women workers in the engineering trade have asked for an alteration of hours of female labour in the engineering workshops from the present 48 to 54 hours to 47 hours.

Electrical Supplies to South Africa.—The *S.A. Mining and Engineering Journal* for February 15th stated that during the preceding week there was no alteration in prices of electrical goods, although plenty of materials were arriving from England, America, and Japan. "Contractors are, in a measure, being held up by the building strike, but outside of that there is quite a lot of work in evidence. One distributing house has been doing quite a good business in C.O.D. railway orders, thus showing an improvement in country orders. The mines are also purchasing rather freely of lamps, wiring, and other materials, as they are not interfered with by the strike. When the latter is fixed up, a lot of activity is anticipated in the electrical business. In the meantime, stocks are accumulating, thus enabling contractors to have a better assortment of all requisites."

American Government Sales of Copper.—It is reported in a Press dispatch from Washington that the War Department announces that an agreement has been come to with copper producers by which approximately 100,000,000 lb. of copper owned by the War Department will be sold in the next 15 months at market prices. In the first 10 months the Metal Selling Co. will dispose of 5,000,000 lb. monthly, and in the succeeding five months 10,000,000 lb. monthly.

Export Trade Commissioners.—In the *Bulletin* of the Federation of British Industries, it is stated that the Overseas Trade Committee has appointed a sub-committee to supervise the Federation's Trade Commissioner Service. The sub-committee will be charged with the duties of considering the qualifications of candidates, and making appointments to Commissionerships, drawing up the necessary regulations governing the service, and making recommendations regarding overseas trade policy. The sub-committee will have power to co-opt, and will generally sit fortnightly. It is expected that the delegation of Brazilian business men will arrive here on June 15th for their tour of industrial Britain.

High-Speed Tool Steel and Scrap.—With reference to the Steel Supplies (Partial Suspension) Order, 1919, the Ministry of Munitions gives notice that after the date of that Order all dealings in high-speed tool steel and scrap therefrom are unrestricted, and consequently the maximum prices applicable to these materials cease to be operative.

Catalogues, Calendars, &c.—The British Westinghouse Electric and Manufacturing Co., Ltd., of Trafford Park, Manchester, have favoured us with one of their wall calendars for the year ending March, 1920. The monthly date slips appear beneath a study which cannot fail to be an attraction on any office wall.

Messrs. Johnson & Phillips, Ltd., Charlton, London, S.E. 7.—In the form of a folder, the company has issued a map of the United Kingdom, effectively showing the very large number of collieries where J.P. electrical plant and cables have been installed. A 32-page catalogue has also been published, entitled "Main Cables," in which a good deal of information is given respecting their power cables. A general specification is followed by notes concerning cable-laying and jointing, vulcanised bitumen insulated cables, low-tension cables, high-tension cables, three-core high-tension cables, three-core E.H.T. cables with earth shield, special cables, split conductor cables, paper-insulated bitumen sheathed cables, rubber-insulated cables, and telephone cables. These are all illustrated with excellent half-tone sectional views, and pictures appear of the paper cable works, and of various cable-laying operations. The company has specialised in cable manufacture for a very long period, in fact its works were established at Charlton in 1875.

Messrs. Higgs Bros., Sand Pits, Birmingham. Stock price list of shunt-wound interpole motors from ·25 to 25 H.P.

Export Prohibitions.—A further list of alterations in export prohibitions appears in the *London Gazette* for March 28th.

Book Notices.—*Electrolysis and Its Mitigation.* Technologic Paper of the Bureau of Standards. U.S.A., No. 52. By E. B. Rosa and B. McCollum. 2nd Edition. Washington, D.C., U.S.A.: The Bureau.—This report relates principally to the prevention of electrolysis in metallic structures, including gas and water systems and lead-covered cables. In America no regulations exist imposing limits on voltage drop in the negative return of tramway supply systems, and consequently electrolysis has given rise to serious troubles on pipes, cable sheaths, &c. "It is probable that more trouble from this source is now being experienced in this country [United States] than anywhere else in the world." Voltage drops of 5 or 6 volts in a few hundred feet are common. The subject is very fully treated, and abundant data are given derived from actual experience. Wide use is now being made of insulating joints in pipes, attempts to protect the pipes with paint, &c., having proved ineffective. The best method, however, is to reduce stray currents to the minimum. A new feature of the revised edition is a section on the three-wire system of railway power distribution, of which several examples exist in the United States.

The March issue of the Industrial League *Journal* includes a 12-page supplement reporting an address by Mr. G. N. Barnes, M.P., to managers and foremen on "Industrial Matters." Mr. H. E. Blain, of the London Underground Railways, contributes an article on "Industrial Honour." There are contributions from Sir Woodman Burbridge, Sir Eric Geddes, Mr. R. Young, M.P., Mr. G. H. Roberts, M.P., Prof. Kirkaldy, Mr. W. C. Bridgeman, M.P., Sir William Bull, M.P., Mr. G. J. Wardle, M.P., and Mr. Tom Shaw, M.P. An article on "League of Nations and Industrial Unity" is contributed by Major the Hon. Waldorf Astor, M.P. There is also a full account of the donation of £20,000 by Colonel Sir William Dupree towards creating industrial harmony.

Trade Announcements.—Mr. C. H. Campion (Campion and Ryan, of New York) is at present in London (6, Old Queen Street, S.W.) representing a number of American manufacturers for the purpose of appointing wholesale factors and distributors of various electrical products. He is also here to complete arrangements for representing British interests in America.

The address of Messrs. Automatic and Electric Furnaces, Ltd., has now been changed to 281-283, Gray's Inn Road, London, W.C. 1 (telephone, Holborn 1295; telegrams, "Elecfurn, Kincross, London"), where larger premises for offices and works have been secured.

The Power Specialty Co., of New York, have opened an office at 315-17, Oxford Street, London, W. 1, to deal with all European business in "Foster" superheaters, the agency for which has until recently been in the hands of Messrs. Heenan & Froude, of Worcester. We have received a copy of the company's fully-illustrated catalogue of 56 pages describing the Foster superheaters.

Mr. J. F. Carr, late Trench Warfare Engineer, West of Scotland, and Mr. T. T. D. Geesin, late of the British Thomson-Houston Co., Ltd., Rugby, and Lt. R.N.V.R., have entered into partnership as Carr, Geesin & Co., electrical and mechanical engineers, at 1, Montague Street, W.C. 1. Telephone: "Museum 3413."

Liquidations and Dissolutions.—Pearsons (Electricians), Ltd.—Winding-up voluntarily. A meeting of creditors was called for yesterday at 15, Fountain Street, Manchester. Liquidators, W. Eaves and A. Yearsley, 27, Brazennose Street, Manchester.

Cedes Electric Traction, Ltd.—Last day for claims April 15th Controller, Mr. H. E. Burgess, O.B., 33, Carey Street, London, W.C. 2.

National Provincial Electricity Corporation, Ltd.—A meeting is called for May 2nd at Balfour House, London, E.C., to hear an account of the winding up from the liquidator, Mr. S. Gillatt.

Pneumatic Tool Co., Ltd.—Winding up voluntarily, with Mr. H. L. Williams, 70, Queen Victoria Street, London, E.C., as liquidator.

Non-Ferrous Metal Industry Act.—Additions to the list of licences granted under this Act appear in the *London Gazette* for March 28th and April 1st.

Wages of Women Engineers.—An Arbitration Court has awarded all women employés in the engineering and allied industries, whether time or piece workers, another 3s. a week, girls under 18 to receive 2s. 6d. The women's Unions had asked for "an increase of 28s. 6d. a week, with an additional advance of 5s. a week." Under the Wages (Temporary Regulation) Act the Labour Ministry has issued an order compelling all employers who have women workers in engineering or boiler shops and foundries to obey the award.—*Daily Mail.*

German Industrial Notes.—The German Babcock and Wilcox steam boiler works have purchased large plots of land in Altstaden for the erection of new premises.—*Weltwirtschafts-zeitung*, February 28th.

The Accumulators Manufacturing Co. in Berlin and the Th. Goldschmidt Co. in Essen have amalgamated their rail-welding departments in the Electro-Thermit Co., Ltd., their methods having been found to be supplementary to each other.—*Kölnische Zeitung*, February 26th.

The Co-operative Electricity Companies attached to the Saxon-Anhalt Electricity Works have combined in a company entitled the Provincial Electricity Co., Ltd., at Halle.—*Kölnische Zeitung*, February 13th.

Nationalisation.—The Council of the F.B.I. recognises that the Federation, which is the largest manufacturers' organisation in the country, cannot remain silent with regard to the policy of nationalisation now being pressed upon the country. On the motion of Mr. W. P. Rylands, a strong committee has been appointed to consider the report of the Royal Commission on the Coal Industry, and to continue to consider the various interim reports of that Commission as they appear; to consider the report of the National Industrial Conference; to take evidence from the various trades with regard to nationalisation: and to report back to the Council.

Parliamentary Question re U.S. Export Plans.—In the House of Commons, on Monday, Mr. Higham asked whether, in view of the fact that the Government of the United States intended to lend to American exporters £200,000,000 of Government money to permit those exporters to sell on credit in Allied and neutral markets, he would state what amount of money His Majesty's Government proposed to set aside for that purpose in order that British traders might be in no less advantageous a position. The reply of Mr. Bridgman, according to the *Times* report, was:—"The hon. member must bear in mind that the war has taxed the financial resources of the British Government more severely than those of the Government of the United States. The Government are fully alive to the importance of the question of credit facilities, which, in the case of some markets, is at present perhaps the chief problem to be solved in connection with export trade. But the solution cannot be a matter either wholly or mainly for the Government."

LIGHTING AND POWER NOTES.

Accrington.—Proposed Extensions.—The Electricity Committee has approved a proposal for the expenditure of £70,000 on additional plant at the electricity works. A report on the scheme has been prepared by Mr. R. Blackmore, of the Stalybridge, Mossley, Hyde, and Dukinfield Electricity Board. The steam-raising and gas-producing plant is inadequate for the present load, and the prospective load will add considerably to the demand. Bulk supplies from neighbouring authorities, or from the contemplated national power stations, are not considered practicable. The capital charges on the new expenditure would be about £7,000 per annum, but it is estimated that the shutting down of the gas-driven plant would save £5,600 a year. The opinion is expressed that if the station is run under steam conditions there would be a substantial reduction in fuel charges, and the total credit is set down at £11,600, leaving a net financial gain of £4,600 a year.

Australia.—E.L. Schemes.—The Corowa (N.S.W.) Shire Council is considering the extension of its E.L. undertaking, at a cost of £4,000. The Yeronga (Q.) Lighting Committee is urging the Stephens Shire Council to install an E.L. scheme. The Erina (N.S.W.) Shire Council is considering an E.L. installation for the town of Gosford.

Tasmania.—The Premier has intimated that if the Mount Lyell Mining Co. does not proceed with the King River hydro-electric scheme, the Government will go on with it.—*Tenders.*

Bandon.—E.L. Scheme.—The Cork C.C. has assented to the proposal of Mr. J. Brennan, a local mill owner, to install an E.L. scheme at Bandon. Energy is to be generated by water power at the site of the mill.

Birmingham.—L.G.B. Inquiry.—Colonel T. C. Ekin held an inquiry on Tuesday, last week, into the application of the T.C. for sanction to borrow £1,126,140 for the purposes of the electricity undertaking. The money is required towards the cost of the new permanent generating station at Nechells, upon the construction of the foundations of which work has been commenced. The Electricity Supply Committee has satisfied the Ministry of Munitions and the Treasury as to the necessity for the work. The initial capacity will be 30,000 kw., and two turbo-alternators, each of 15,000 kw., are to be installed. The mains between Nechells and Smethwick are to be linked-up.

Burnley.—Electricity in Mining.—New electrical pumping plant at Messrs. Hargreaves's Mountain Mine was inaugurated on March 26th. Burnley Corporation is supplying the power at 6,600 volts. The new pump is of the multi-stage turbine type, supplied by Messrs. Mather & Platt, Ltd., of Manchester. This supersession of steam for electricity has proved so successful that a second electrical instalment is shortly to be made at Arley Colliery, Burnley.

New Services.—The Corporation has received so many applications for power that it has instructed a deputation to consult an expert as to steps required to expedite Government sanction for urgently required extensions.

Colne.—Proposed Loan.—The Electricity Committee has applied to the L.G.B. for a loan of £36,283, for the extension of the generating plant and mains.

Continental.—Sweden.—Among the new companies formed in Sweden in connection with the utilisation of water power for electricity supply, are the Toarps Elektriska Aktiebolag, of Dalsgofors; the Odeshogs Elektriska Aktiebolag, of Odeshog; and the Gotbergs Kraft Aktiebolag, of Gothenburg.

Dundalk.—Price Increase.—The U.D.C. has decided to increase the charges for electricity by a further 12½ per cent. for six months.

Edinburgh.—Bulk Supply.—The agreement between the Edinburgh T.C. and the Leith T.C. for the supply in bulk of additional electricity from the Dewar Place power station has been adjusted on the lines suggested by the B. of T.

Egham.—Proposed Price Increase.—The U.D.C. has objected to the application of the electricity company for consent to increase the price of electricity from 8d. to 1s. per unit.

Glasgow.—National Electricity Supply.—The Glasgow T.C. has decided to oppose the proposal to put the future control of electricity supply in the hands of a Ministry of Ways and Communications. In a report on the subject, Mr. W. W. Lackie, the chief engineer, states that he is of opinion that the supply of electricity warrants the appointment of a special minister or board, and electricity should certainly not be tacked on to the Ministry of Ways and Communications, as a minor item. He regards the power to let on lease any undertaking acquired by the Ministry as dangerous, as any undertaking might be taken from a public body and let to a private company.

Haslingden.—Price Increase.—The Corporation has decided to advance the price of electricity for lighting to 6d. per unit, and for heating and power by 25 per cent., making a total increase of 50 per cent. on the original charges.

Proposed Bulk Supply.—The electrical engineers of the Accrington, Haslingden and Rawtenstall Corporations have held a conference regarding the supply of electricity in bulk, and a further conference is shortly to be held.

Hatfield.—E.L. Scheme.—The R.D.C. has asked the North Metropolitan E.P.S. Co. to supply electricity within its area.

Herne Bay.—E.L. Scheme.—The U.D.C. has decided, owing to the inability of the Gas Co. to supply electricity, to relieve the company of its obligations, on condition that it does not oppose Mr. Hunt supplying energy in the district.

Hornsey.—Price Increase Disapproved.—The Middlesex C.C. has disapproved the application of the B.C. for permission to increase the charges for electricity from 8d. to 10d. per unit.

Ilford.—Price Increase.—From the end of June, the Electricity Committee recommends that the charges for electricity be increased as follows:—Lighting, 7d. per unit; residential premises, 12½ per cent. on rateable value, plus 1½d. per unit, plus 75 per cent.; maximum demand, 8d. and 5d.; slot meters, 7½d.; power, maximum demand, 5d. and 3d.; or up to 500 units per quarter, 5d. per unit, next 1,000, 4d., next 1,000, 3d., over 2,500, 2¾d.; heating, 3d.; cinemas, vehicle charging, &c., an addition of 25 per cent., making a total increase of 100 per cent.

India.—Generating Costs.—With a generating plant capacity of 20,800 kw., the Calcutta Electric Supply Corporation has the largest steam plant in India, its power costs being 0·751d. per unit. The Bombay Electric Supply and Traction Co. is able to supply power at a cost per unit of 0·722d., while the Tata Hydro-Electric Power Supply Co. has reduced the generating costs to 0·1d. per unit.

Lancaster.—Proposed Expert Advice.—The chairman of the Electricity Committee has recommended that an expert be called in to report on the present position of the electricity undertaking.

London.—Electricity Loans.—The L.C.C. has been informed by H.M. Treasury that, while it cannot give general authority to allow all electricity loans, it is prepared to favourably consider applications made through the Council where such loans are urgently needed for industrial purposes or housing schemes, and not merely for domestic purposes.

Battersea.—Price Increase.—The Electricity Committee has recommended that the charges for electricity for lighting be increased from 4d. per unit, plus 10 per cent., to 5d., plus 10 per cent., and for power from 1¼d. to 1¾d. per unit net, from the next reading of the meters.

Southwark.—Proposed Price Increase.—The B. of T. having refused the application of the B.C. to increase its charges for electricity for lighting purposes from 8d. to 1s. per unit, the Electricity Committee has now recommended the Council to apply for sanction for an increase to 9d. per unit.

Lambeth.—Electricity Charges.—The B.C. has refused an application of the South London E.S. Corporation for permission to increase its charges for lighting from 6d. to 7d. per unit.

Middlesbrough.—Garden City Lighting.—The Sanitary Committee has decided to light the new garden city at Acklam with electricity.

Peterborough.—Wages.—On the ground that the cost of living is decreasing, it is stated that the Electricity Committee has refused to give its employés the 5s. per week bonus granted by the Committee on Production last November.

Portstewart.—Proposed Municipal Control.—The U.D.C. has decided to ask the Irish L.G.B. for permission to take over the electric lighting plant.

Ripon.—E.L. Scheme.—The T.C. has appointed Mr. A. Redfern, of Darlington, to be consulting engineer in connection with the proposed E.L. scheme for the town.

Rugby. — Municipal Contracting. — The Master Builders' Association has protested against the proposal of the U.D.C. to open showrooms and carry out electrical work within its area. The Electricity Committee has stated that it does not intend to run the department for profit, and has declined to take any action with regard to the protest.

Salford.—Bulk Supply.—The Electricity Committee has renewed its agreement with the Lancashire E.P. Co., for a bulk supply of electricity for a further 12 months.

Stand-by Charges.—The Committee has decided to charge a minimum of £2 per kw. in cases where it furnishes a stand-by to a private installation, irrespective of the amount used.

South Africa.—Mossel Bay (Cape Province).—The T.C. has decided to embark on an electric lighting scheme, at an approximate cost of £20,000. An engineer is to be engaged at once, in order to revise previous plans and specifications.

Elliott (Cape Province).—The municipality proposes to raise a loan of £1,800 for the purpose of an electric lighting scheme.

St. Helens. — Proposed Extensions. — The borough electrical engineer has been instructed to prepare a scheme to meet the increased demand for electricity.

Stockton.—Price Increase.—The Corporation has increased the charges for electricity for lighting and power by 5 per cent., as from April 1st.

Thurles (Co. Tipperary).—E.L. Scheme.—The U.D.C. proposes to spend £7,000 on providing an electric light scheme.

Wages.—The court of arbitration to which we referred last week in these columns, has refused the application of the Electrical Trades Union for an advance of 15s. per week for its members employed in electricity undertakings in London and district. The court stated that the men concerned were receiving a total war bonus of 28s. 6d. per week, plus 12½ per cent. in the case of time workers, and 7½ per cent. in the case of piece workers, and that the circumstances did not justify any further general alteration of wages.

Warminster.—Extension of Time.—The B. of T. has extended the time authorised under the Warminster E.L. Order, 1914, for six months from January last.

TRAMWAY AND RAILWAY NOTES.

Blackpool.—Tramways Purchase.—With regard to the proposed purchase by the Corporation of the Blackpool and Fleetwood Tramroad Co.'s undertaking, the House of Lords Committee appointed to consider the matter has been informed that the Blackpool and Fleetwood Corporations have come to an agreement by which the Blackpool Corporation will acquire and work the whole undertaking, and the Fleetwood Corporation will have an option to purchase that portion of the system which is within its area within a certain period.

Burnley.—48 Hours' Week.—The working hours of the Corporation tramway workers have been reduced from 54 to 48 per week, the wages remaining the same, which will entail a cost of £10,000 per annum.

Chile.—Proposed Railway Electrification.—The State Railway Authorities contemplate the electrification of the line from Valparaiso to Santiago, 116 miles. Two prominent engineers, Rafael Edwardes and Ricardo Solar, will arrive soon to continue their investigations of the problem.—*Railway Review.*

Duty of a Conductor.—The duty of a tramway-car conductor was the subject of comment by the Deputy Coroner for North Worcestershire at an inquest near Birmingham, last week, on a man who was knocked down and killed as he was alighting from a tramway-car. The conductor said the car had not stopped when the man got off, and added that conductors were not supposed to hold back people who attempted to jump off. The Coroner said that when a man 74 years of age was allowed to get off a car before it had stopped, the conductor was neglecting his duty. In returning a verdict of "Accidental death," the Coroner said no blame attached to anyone; the whole duty of a conductor, however, was not to collect fares only—he must exercise discretion and look after passengers.

Liverpool.—Year's Working.—The income of the Corporation tramway department for the year 1918 amounted to £989,505, against £845,646 in the previous year; working expenses totalled £715,979, interest absorbed £50,969, sinking fund £52,734, reserve and depreciation fund £29,322, and £140,000 was contributed to the relief of the rates. The cost of electricity was £138,426, or 2·74d. per car-mile, against 2·584d. in 1917. The receipts per car-mile were 18·91d., against 15·56d.; the average fare per passenger was 1·184d., against 1·137d.; the total charges were 16·12d., against 12·89d.; and the operating cost was 14·082d., against 10·931d. The length of track in operation was 124 miles; the capital expenditure at the end of the year was £2,068,395; 195,082,609 passengers were carried, an increase of £22,240,115, and 12,210,763 car-miles were run. Of the total staff of 3,000, 2,300 left to join the Forces. The Committee has decided to purchase 100 motor-omnibuses in order to relieve the traffic congestion, as it was found that these could be delivered earlier than new tramcars. As soon as possible 100 new tramcars are to be purchased. During the war the Committee placed the Lambeth Road works, and the services of the general manager and his technical staff, at the disposal of the Government, and over two million shells passed through the factory; 300 aeroplanes were completely manufactured there, and 200 were in course of construction when the Armistice was signed. The reserve and renewals fund now totals £916,354, and £1,062,899 has been contributed to the rates.

London.—L.C.C.—Year's Working.—For the year ended March 31st, 1918, the total income of the tramway department amounted to £2,932,140, compared with £2,552,204 in the previous year, while the working expenses were £2,128,686. Of the gross surplus of £803,455, interest absorbed £293,569; and debt redemption, £428,320; after allowing for recoverable charges there was a net surplus of £95,559, which has been transferred to the renewals fund. Passengers carried during the year totalled 593,516,141, against 586,127,976, and 49,189,866 car-miles were run, against 49,478,973. The total revenue averaged 14·3d. per car-mile, against 12·38d.; the average fare per passenger was 1·16d., against 1·01d.; working expenses were 10·38d. per car-mile, against 8·82d., including ·62d. in respect of war-service allowances and other special charges. The average number of cars in use was 1,269, compared with 1,825 in stock. The net capital expenditure during the year was £89,470, and the total capital expenditure to the end of the year was £13,659,589, of which £5,015,789 had been paid off out of revenue. The total track mileage was 149, of which 122 were on the conduit system and 22½ overhead; 4·6 miles of horse tramways, not yet electrified, were not worked. The renewals fund stood at £324,451, and the general reserve fund at £74,667. During the year, £119,432 was paid in respect of employés with the Forces. The cost of war wages and bonuses was £321,125. The amount paid to local authorities as rates on the permanent way was £65,180. Altogether it is estimated that the saving to local authorities in connection with the maintenance of track, street improvements, and rates was £285,220.

The L.C.C. has applied for Parliamentary powers for the construction of new, and the reconstruction of existing, tramways.

The concession of the 44 hours' week to tramway workers will cost £360,000 per annum. Steps are being considered to secure the additional revenue necessary, a further increase of fares being expected.

Collision.—A collision occurred on Wednesday morning, last week, just outside Waterloo Station, at a spot where a number of tracks converge, the trains involved being the 8.10 a.m. outgoing electric and an incoming steam train. The rear coach of the electric train fouled the points, and became detached; it was struck by the incoming steam train. The steam locomotive and several coaches were derailed, one of the latter being smashed. Only one passenger was slightly injured. The mishap caused considerable dislocation of traffic, and as each incoming train was stopped in its section, passengers left the carriages and walked along the track to Waterloo and Vauxhall. Some trains were got through on the Windsor line, and about 2 p.m. traffic began to settle down.

L.U.T. Service Curtailment.—Commencing Monday last, the early morning services on the L.U.T. system were slightly curtailed, the first cars leaving all termini later than hitherto.

Extension of Time.—The City and S. London Railway Co. has notified the L.C.C. of its intention to apply for an extension of time for the reconstruction of its system and the construction of subways at Stockwell and Clapham Common.

Marylebone.—The Borough Council has refused to approve the L.C.C. Bill for constructing a tramway along Tottenham Court Road.

Improved Tube Services.—The number of trains in operation on the Piccadilly Railway, between the hours of 10 a.m. and 5 p.m., has been increased from 18 to 24 per hour.

Wood Green District Council is calling a conference of local authorities in North Middlesex to demand an extension of the Piccadilly Tube from Finsbury Park to Enfield. An old agreement between the Government and the G.N. Railway Co. forbids an

extension, but the Council takes the view that circumstances have changed.

An additional turbo-generator of 15,000-kw. capacity, with all auxiliary plant, has been ordered for the Metropolitan District Co.'s power station at Lots Road. Its cost will be slightly more than double that of a similar alternator installed before the war.

Underground Fares Revision.—Certain fares on the District, Bakerloo, Piccadilly, Hampstead, Central London, and City and South London Railways are to be increased on April 6th, and season ticket rates will be revised at a later date.

Maidstone.—Fare Revision.—The T.C. has decided to increase the tramway fares by 25 per cent., and, conjointly with other local authorities, to apply to the B. of T. for permission to increase the fares by 100 per cent.

Mansfield.—Proposed Light Railways.—The Mansfield and District Light Railway Co. has applied to the Light Railway Commissioners for powers to construct five lines of railways in the district.

Reading.—Hours of Labour.—The T.C. has intimated that it does not intend to accept the agreement for a 48-hour week for tramway employés; it is expected that a conference will be held on the matter.

Stoke-on-Trent.—Proposed Municipal Purchase.—The T.C. is negotiating for the purchase of the tramway system within its area.

TELEGRAPH AND TELEPHONE NOTES.

Automatic Telephones.—According to the *Daily Mail*, the Postmaster-General is preparing for the introduction of automatic telephones throughout the Greater London telephone area. A report which has recently been prepared shows that the necessary alteration of exchanges and instruments would take about three years. The cost would be £5,000,000, and it is estimated that the saving in the cost of working would just balance the cost of this capital outlay. The necessary work in London cannot be begun for some time. Orders have been given for the immediate installation of automatic telephones at Sheffield and Dundee. To improve the telegraph and telephone services between London and the Midlands, work has been begun on a new underground cable system between London, Leicester, Leeds, Nottingham, Manchester, and Liverpool.

Cable Delays.—Attention is again called to the delay in cable messages by a suggestion from the Hong-Kong Chamber of Commerce that the naval high-power wireless station there should be used for commercial purposes. It is pointed out that there is an absolute necessity of linking-up Hong-Kong and London by relays of wireless stations, and it is urged that provision be made at the earliest possible moment for direct communication with Calcutta. Telegrams from Egypt, S. Africa, Australia, the Far and Near East received in London during the last month have been subject to delay varying from 4 to 40 days. Of 35 examples cited, 19 have been subject to 10 or more days' delay.—*The Times.*

Mr. Pike Pease states that it has not been possible to do much in the direction of laying new cables for general telegraph service during the war, but steps are now being taken to provide additional lines as quickly as possible.

Colombia.—The Government has granted to the Marconi Wireless Telegraph Co. of America the exclusive privilege for a period of ten years of manufacturing, using, selling, or exploiting in the Republic its wireless telegraph improvements and processes. —*T. and T. Age.*

France.—The staff of the Central Telegraph Office at Paris, says the *Petit Parisien*, ceased work from 6 to 7 p.m. on Wednesday and from 11 to 11.30 on Thursday, last week, as a protest against delay in granting a dear-living allowance and a weekly holiday.

Germany.—Herr Bredow, well known in England as the managing director of the German Telefunken (Wireless) Co., has been made director of wireless in the German G.P.O., says the *Daily Mail*. It is the intention of the German Government to make wireless henceforth an extensive and integral part of the postal system, especially for commercial and Press traffic.

Post Office Record Year.—According to the Accountant-General's report issued last week, the Post Office completed during the year ended March 31st last its best 12 months on record. The profits on the working of the undertaking were:—Postal service £6,848,285 and telephone service £355,468. There was, however, a loss of £556,330 on the telegraphs, reducing the net profit to £6,647,423. The loss on the telegraphs during the previous five years was:—1912-13, £1,175,347; 1913-14, £1,211,742; 1914-15, £1,232,955; 1915-16, £520,047; 1916-17, £529,639.

United States.—The Moon Bill to extend Government control over telephone and telegraph systems was not passed by Congress before the adjournment early in March.

The Postmaster-General has ordered internal telegraph rates to be advanced 20 per cent. as from April 1st, to meet the added costs of the service due to recent increases of wages.

Mr. Lansing states that the United States will soon have its own cables across the Atlantic and the Pacific and to the Far East.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Brisbane.—May 15th. Department of the Treasury. H.T. switchboard, storage battery and motor-generator set for the electric power house, Inkerman Irrigation Area, Townsville. Specifications from the Hydraulic Engineer, Brisbane.

Melbourne.—May 14th. Victorian Railway Commissioners. Cells, renewals, caustic soda and mineral oil for caustic soda batteries. (Contract No. 32,194.)

Sydney.—June 9th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.*

Bedford.—Corporation Electricity Department. Geared turbine to drive an existing alternator. (March 21st.)

Birmingham.—April 12th. B. of G. Rewiring internal telephone installation, call bells, &c., at the 2/1st Southern General Hospital, Dudley Road. (March 28th.)

Eastbourne.—April 16th. Electricity Department. One water-tube boiler, with superheater and travelling-grate mechanical stoker. (See this issue.)

Grimsby.—April 10th. Corporation Electricity Department. One 3,000-kw. steam turbine, 6,000/6,600-volt, 3-phase alternator, condenser, pumps, &c.; two water-tube boilers, stokers, superheaters, fans, steel chimney, &c.; cooling tower, &c. (March 21st.)

London.—H.M. Office of Works. Two 10-ton, three-motor type, 450-volt, D.C. travelling cranes, 42-ft. span and 60-ft. span. (March 28th.)

Pudsey.—Electric light installation for Unitarian Church. Specification from Rev. R. Newell, 35, Crawshaw Street.

Sale.—U.D.C. Electricity Department. 200/250-kw., 460-volt, Diesel engine and generator, switchboard panel, &c. (March 28th.)

*A copy can be seen at the Inquiry Office of the Department of Oversea Trade (Development & Intelligence), London.

CLOSED.

Australia.—P.M.G.'s Department, N.S.W. Material for automatic telephone exchanges in Sydney. £861. Automatic Telephones (Aust.), Ltd.—*Tenders.*

Glasgow.—Tramways Committee. Accepted:—

(1) Copper.—Charles Henderson & Co., Ltd.
(2) Gear cases for 49B motors.—The British Westinghouse E. & M. Co., Ltd.

Ilford.—Recommended:—

One Fraser & Chalmers turbine, direct coupled to Siemens alternator £12,569; Worthington-Simpson condensing plant, £4,961; one 1,000-kw rotary converter and starting panel, £5,705; 2,100/6,600-volt step-up transformers, £2,292; switchboard, 5-cubical, 6,600-volt, £1,072; 1,000-kw., D.C. switch-panel, £275.—General Electric Co., Ltd.

One 60-in. Sirocco induced-draught fan, &c., £454; one 65-h.p. motor and starting panel, &c., £489.—Davidson & Co., Ltd.

St. Helens.—Electricity Committee. Accepted:—

Cable.—B. I. & Helsby Cables, Ltd.
Spare armature for motor.—British Thomson-Houston Co., Ltd.

Worthing.—T.C. Tenders accepted on Tuesday:—

Mirrlees, Bickerton & Day, Ltd.—500-b.h.p. Diesel engine, £8,793.
General Electric Co., Ltd.—Sub-contractors to above, 345-kw. dynamo, £1,652.
Bruce Peebles & Co., Ltd.—Balancing transformer and switchgear, £270.

The electrical engineer (Mr. G. Porter) and the Chairman of the Electricity Committee interviewed Admiralty Officials with reference to an offer of certain second-hand plant available for disposal, but they could not recommend the Committee to accept it.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, April 4th. At 7.30 p.m. At 39, Victoria Street, S.W. Lecturette on "Modern Methods of Water Treatment," by Mr. J. P. O. Callaghan.

London Association of Foremen Engineers.—Saturday, April 5th. At 7 p.m. At Cannon Street Hotel, London, E.C. Paper on "The Science of Fine Measurements," by Mr. V. Williams.

Salford Technical and Engineering Association.—Saturday, April 5th. At the Royal Technical Institute. At 7 p.m. Lecture on "Pig Iron: its Source, Manufacture, and Use," by Mr. W. Rawlinson.

Royal Institution of Great Britain.—Saturday, April 5th. At 3 p.m. At Albemarle Street, W. Lecture on "Spectrum Analysis and its Application to Atomic Structure," by Sir J. J. Thomson, F.R.S.

Friday, April 11th. At 5.30 p.m. At Albemarle Street, W. Lecture on "Piezo-Electricity and its Applications," by Sir J. J. Thomson, F.R.S.

Society of Engineers (Inc.).—Monday, April 7th. At 5 p.m. At Burlington House, W. Lecture on "Modern Explosives," by Prof. J. Young.

Illuminating Engineering Society.—Tuesday, April 8th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 8 p.m. Discussion on "Light and Colour in Relation to Stage Production," to be introduced by Mr. J. B. Fagan.

Institution of Civil Engineers.—Tuesday, April 8th. At 5.30 p.m. At Gt. George Street, S.W. Paper on "The Electrical and Mechanical Equipment of the all-metal Cars of the Manchester-Bury Section L. & Y. Railway," by Mr. G. Hughes, and paper on "All-metal Passengers' Cars for British Railways," by Mr. F. E. Gobey.

Association of Engineers-in-Charge.—Wednesday, April 9th. At 7.30 p.m. At St. Bride's Institute, Bride Lane, E.C. Paper on "The Relationship Between Wages, Output and Improved Standards of Living from a Practical Point of View," by Sir Wilfred Stokes, K.B.E.

Institution of Electrical Engineers.—Thursday, April 10th. At the Institution of Civil Engineers, Great George Street, S.W. At 6 p.m. Paper on "Notes on Surface Condensing Plant, with Special Reference to the Requirements of Large Power Stations," by Mr. R. J. Kaula.

(North-Eastern Centre).—Friday, April 4th. Annual dinner.

(North-Western Centre.)—Tuesday, April 8th. At the Engineers' Club, Albert Square, Manchester. At 7 p.m. Annual general meeting and discussion on the President's Address to the Territorial Centres.

(Scottish Centre).—Tuesday, April 8th. At 207, Bath Street, Glasgow. At 7.30 p.m. Annual general meeting. Lecture on "The Navigational (Magnetic) Compass as an Instrument of Precision," by Mr. M. B. Field, O.B.E.

(North Midland Centre).—Tuesday, April 8th. At the Metropole, King Street, Leeds. At 7 p.m. Paper on "The Determination of the Efficiency of the Turbo-alternator," by Dr. S. F. Barclay and Dr. S. P. Smith.

Belfast Association of Engineers.—Thursday, April 10th. At 7.45 p.m. At the Municipal Technical Institute. Annual general meeting.

Chief Technical Assistants' Association.—Friday, April 11th. At 7 p.m. At Anderton's Hotel, Fleet Street, E.C. Discussion on "Problems of Linking-up."

National Foremen's Association of Engineering, Shipbuilding and Allied Trades (West London Branch).—Saturday, April 12th. At 6.30 p.m. At the Norfolk Arms Hotel, Burwood Place, Edgware Road, W. Ordinary meeting.

Royal Society of Medicine.—Tuesday, May 6th. At 8 p.m. At 1, Wimpole Street, W.1. Second Silvanus Thompson Memorial Lecture, by Prof. W. M. Bayliss.

THE ELECTRICAL TRADES BENEVOLENT INSTITUTION.

The following is a list of further contributions received in response to the appeal made by Mr. Hunter, the chairman of the E.T.B.I.:—

Johnson, Matthey & Co	£5	5	0	A. C. Bostel	£0	10	0
E. Atkinson	0	10	0	E. A. Harvey	0	10	6
Wm. White & Co.	1	1	0	J. H. Sandiford	0	10	6
R. Cruickshank, Ltd.	0	10	6	Crypto Electrical Co., Ltd.	1	1	0
The "Electrical Review"	21	0	0				

On Friday last the annual general meeting of the Benevolent Institution was held at the Institution of Electrical Engineers. Mr. C. H. Wordingham presided, and moved that the report of the Committee and the accounts for the year 1918 should be approved; he stated that the total income was £1,168, as compared with £1,164 in 1917, and the total contributions were £746, compared with £782. In 1914, the last year in which the Annual Festival was held, the total contributions were £3,140. Members' subscriptions had fallen from £138 in 1917, to £131 in 1918, but the number of members had increased from 148 to 176. Dividends received were £432, compared with £381, and the total cost of working the Institution was £186, compared with £159, the increase being due to the increased cost of postage and stationery. As the Annual Festival could not be held last year, the chairman of the last annual general meeting, Mr. Hunter, undertook to make an appeal to the electrical industry, but owing to the illness of many members of his staff, the issue of the appeal was delayed, and the amount collected—£1,302—was not included in the accounts for 1918. The pension fund had now passed £10,000; the time when pensions would be called for was approaching, and but few pensions could be paid out of the dividends from the invested funds. Only two applications for temporary relief were made during 1918, and were met by grants; it was the policy of the Institution to endeavour to find work for those who were destitute, and on many occasions in the past, applicants had been given financial assistance to enable them to obtain suitable employment—every qualified person who had applied for assistance had received it.

The total holding of War Loan had been increased to £4,500.

The policy of creating Local Committees brought about most satisfactory results in Cardiff and district, mainly due to the energetic action of Mr. Hobbs, a member of the Committee of the Institution. A concert organised by this Local Committee in January last brought in the sum of £112. Local Committees were in process of formation at Bristol, Birmingham, and Manchester, and it was hoped in 1919 to get to work in this direction at Newcastle, Sheffield, Edinburgh, and Glasgow. Collectors had gathered a considerably increased amount; it was to be regretted that the heads of the majority of firms in the electrical industry did not assist the Institution more by appointing collectors from amongst the members of their staffs; such collectors not only brought in funds, but could also gain members more effectually than any other means.

The report and accounts were unanimously adopted, and votes of thanks were accorded to Mr. Hunter, the auditors, and the Institution of Electrical Engineers.

The members of the Committee who retired by rotation were re-elected, and Mr. R. W. Hughman was also elected a member of Committee.

It was decided that Mr. W. R. Rawlings should be invited to preside at the next annual festival.

NOTES.

London Electrical Engineers, R.E. (T.F.).—All ranks who have at any time served with the above corps are requested to send full particulars of present address, promotions, appointments, rewards, and casualties to the Officer Commanding, 46, Regency Street, London, S.W. 1.

Power Station Coal Consumption.—The technical adviser to the Controller of Coal Mines (Mr. D. Wilson) estimates that 10 to 15 million tons of coal could be saved per annum if the efficiency of all industrial works was raised to a reasonable standard. For the year ending March, 1918, 1,421 steam-operated power stations in the kingdom, excluding private stations, railways, and tramways, produced 4,674 million units for a coal consumption of 3·47 lb. per unit, or a total of slightly over 7 million tons of coal, the average thermal efficiency being about 8·49 per cent. Half the electrical energy in the country was supplied by 40 of those stations, their coal consumption being 2·57 lb. per unit, with a thermal efficiency of 11·5 per cent.; the remaining stations had an average of 6·8 per cent. These figures could, however, not be taken as conclusive arguments for super-power stations, as the following table shows, the stations A, B, and C being in the South of England, while D, E, and F are in other parts of the country:—

	A.	B.	C.	D.	E.	F.
Output (million units) ...	200	40	22	200	46	28
Coal consump. (lb. per unit)	2·53	2·32	2·49	2·78	2·4	2·4
Thermal efficiency (p.c.) ...	13·88	15·05	11·95	10·38	12·35	12·15

Electricity Supply Commercial Association.—The first general meeting of the West of England Branch was held at Bristol on Friday last, Mr. Thos. H. Gait (Bristol) presiding over a numerous attendance. Representatives from Bath and Gloucester were also present. The "Aims and Objects" were outlined, and the rules governing the Association were fully discussed. A Divisional Council was elected, and it was decided to get in touch with all electricity supply undertakings in the area allotted to the Branch, viz., Oxford, Devon, Cornwall, Somerset, and Gloucester; anyone in these counties desiring information should communicate with the Acting Secretary, Mr. Thos. H. Gait, 51, Howard Road, Westbury Park, Bristol.

Co-operation.—Mr. F. B. van Doren, writing in the *Electrical World*, points out that co-operation is essential in all phases of successful living, and perhaps nowhere more so than in the work of preventing accidents. Of the safety-first idea it is the quintessence. Where little or no co-operation exists, one will find dissatisfaction, discord, low efficiency, and numerous accidents.

"Everyone must have seen plants where the attitude of the employé is, 'Why should I care? The boss doesn't care anything for me except to get 10 or 12 hours' work. Why, when we leave the shop he never thinks of us again.' Do you suppose such a company is getting what it should in production, or what it would if some thought were given to the other fellow?

"That employer who has no thought for his employés after working hours will sooner or later find the better employés seeking employment elsewhere, and the others reciprocating the feeling. His accident record will not only be high, but his labour turnover also will be high.

"Most men are born sociable, and appreciate it when a good word is spoken to them. You can call it what you please—salve or blarney; nevertheless, from the highest to the lowest, they like it. It should not be inferred that an employer should be insincere; that would be disaster. But to give out words of good cheer, and have them come from the heart, works wonders."

"If sickness or injury comes to one of your employés, visit his home. See if he or his family is in need. This cannot always be done by the employer himself, but he can appoint some good person in his organisation to do it. He will find it will never be forgotten by either the man or his family, and returns will follow beyond expectation."

"If the confidence of the employé is once gained, it is an easy matter to hold it. Before it can be held, however, one must lay all the cards on the table, and be absolutely honest and sincere. Confidence once lost is very hard to regain. Employés are not slow to resent dishonesty, and if practised it will soon cause trouble. Honesty is the best policy with employés and public alike."

An A.E.G. Peace Conference!—The following are attached to the German delegation which is going to Versailles in connection with the Peace terms:—Dr. Walther Rathenau; Herr Deutsch, managing director of the Rhenish electrical combine; Dr. Heineken, managing director of the A.E.G.; Herr Schmidt, managing director of the Frankfort metal combine; and Herr Penkenberg, of the Phœnix Iron Works.—*Daily Mail.*

E.T.U. Ballot Result.—The ballot of the Electrical Trades Union has resulted as follows:—For making application for a working week shorter than 47 hours, 7,840; against, 1,179. There was a majority of 4,486 for ceasing work for a 44-hour week, and a majority of 2,452 against ceasing work for a 40-hour week. The figures are 472 short of the necessary three-fourths majority for a strike on either proposal.

G.P.O. Electricians and the E.T.U.—A number of men employed in the Telephone Engineering Department of the Post Office, unable to obtain through their trade union the same wages and bonuses as other men in the electrical industry, have joined the Electrical Trades Union.

Inquiries.—Makers of the "Premier" tumbler switch are asked for; also makers of the "Bengal" type of regulator, and of "Platina c," a substitute for platinum.

Institution and Lecture Notes.—Institution of Electrical Engineers.—The following have been nominated by the Council for the vacancies which will occur in the offices of President, Vice-Presidents, Hon. Treasurer, and Ordinary Members of Council, on September 30th, 1919:—

President (one vacancy).

Roger T. Smith (electrical engineer, Great Western Railway).

Vice-Presidents (two vacancies).

L. B. Atkinson (secretary, Cable-Makers' Association).

W. B. Woodhouse (manager and chief engineer, Yorkshire Electric Power Co.).

Hon. Treasurer (one vacancy).

J. Devonshire (managing director, London and Suburban Traction Co., Ltd.).

Ordinary Members of Council.

Members (three vacancies).

S. G. Brown, F.R.S. (electrical engineer and managing director, S. G. Brown, Ltd.).

Dr. W. H. Eccles (Professor of Electrical Engineering and Applied Physics, City and Guilds Technical College).

S. E. Fedden (general manager and engineer, Corporation Electric Supply Department, Sheffield).

A. L. C. Fell (chief officer, L.C.C. Tramways).

F. Gill (consulting engineer, Winchester House, E.C.).

W. Judd (late electrician-in-chief, Eastern and Associated Telegraph Companies, Ltd.).

B. Welbourn (contract manager, British Insulated and Helsby Cables, Ltd.).

Associate Members (three vacancies).

H. J. Cash (President, Electrical Contractors' Association (Inc.)).

J. R. Cowie (assistant engineer, Glasgow Corporation Electricity Department).

E. A. Gatehouse (The British Thomson-Houston Co., Ltd.).

Associates (two vacancies).

P. R. Allen (Castner-Kellner Alkali Co., Ltd.).

P. D. Tuckett (director, City of London Electric Lighting Co., Ltd.).

The next informal meeting will, by kind permission, be held in the rooms of the Chartered Institute of Patent Agents, Staple Inn Buildings (South Block), close to No. 335, High Holborn, W.C., on Monday, April 14th, at 7.30 p.m., when Dr. R. D. Gifford will open a discussion on "Electrical Instruments."

Visits to the Osram-Robertson Lamp Works, Brook Green, Hammersmith, W., have been arranged for Monday, April 14th; Monday, May 12th; and Monday, June 2nd. Each party will be limited to 24 members, who will assemble at the main entrance of the works at 2.30 p.m. Members wishing to take part in these visits are requested to send to the Secretary of the Institution, not later than six days before the visit selected, their names, private addresses, and business addresses.

The annual meeting of the Western Centre was held at Bristol on Monday last. The ballot for Officers and Committee Members for the Session 1919-20 resulted as follows:—

Chairman, Mr. A. Ellis (Cardiff).

Vice-Chairmen, Mr. A. J. Newman (Bristol); Mr. A. C. McWhirter (Cardiff).

Committee, Messrs. T. E. Alger, J. W. Collins, F. W. Hunt, G. H. Langdon, W. Collins.

Mr. A. P. M. Fleming, O.B.E., read his paper on "Planning a Works Research Organisation," which provoked a lengthy discussion.

Iron and Steel Institute.—The annual meeting of the Institute will be held on May 8th and 9th, 1919, at the Institution of Civil Engineers, Great George Street, S.W. On the morning of the 8th, the annual report and statement of accounts will be presented, and the Bessemer Medal will be awarded to Prof. Cav. F. Giolitti, of Turin. A number of technical papers will be read and discussed on the morning of the 8th, and during the following day. At 2.30 p.m. on the 8th, by invitation of the Institution of Electrical Engineers, a joint session will be held to discuss the following papers on electric steel furnaces:—"Developments in Iron and Steel Electric Furnaces," by J. Bibby; "The Booth-Hall Electric Furnace," by W. K. Booth; "The Development of the Electric Melting Furnace," by D. F. Campbell; "The Control of Electric Arc Furnaces," by H. Coates; "New Type of Electric Furnace," by Axel Sahlin; and "Large Electric Furnaces," by Victor Stobie. Members may obtain advance copies of these papers on application to the Institute.

To celebrate the Jubilee of the foundation of the Institute, the annual dinner will this year be held at the Guildhall.

The autumn meeting will be held on September 18th and 19th, at the Institution of Civil Engineers.

Electrical Power Engineers' Association.—A general meeting of the Barrow and North-Western Section of the Association was held at St. Nicholas View, Carlisle, on Saturday, March 29th. Mr. G. E. Smith, chairman of the Section, presided over a representative gathering of engineers. Mr. A. O. Holt (assistant divisional secretary, Manchester) gave an address on the aims and objects of the Association. A discussion ensued, and, as a result of the meeting, a considerable influx of members is anticipated into the Section. The Section Secretary is Mr. J. F. Heslop, 7, Victoria Road, Barrow-in-Furness.

The first dinner of the Glasgow Section of the Association was held in the Trades Restaurant, Glasgow, on Saturday, March 22nd, Mr. G. L. Black, chairman of the Section, presiding. The chairman gave some particulars of the progress of the Association, and Mr. W. W. Lackie, chief engineer and manager, Glasgow Corporation electricity department, expressed his pleasure at being present. Remarks were also made by Mr. Cooper, chairman of the Scottish Division. During the evening an excellent musical programme was rendered.

Electric Steel Furnaces.—Mr. Victor Stobie read an interesting paper on "Electric Furnaces in Steel Making" at the last meeting of the West of Scotland Iron and Steel Institute in Glasgow. The main points of the process of manufacturing electric steel were described by Mr. Stobie, who declared that where an electric furnace had been a failure in a steel foundry the onus had almost always fallen on the installation itself. When installing an electric furnace the following points should be kept in view:—(1) There must be plenty of room for the furnace operators all round the plant; (2) the furnace should not be in a stagnant atmosphere; (3) the transformer chamber should be below furnace level when possible, so as to avoid the near presence to the furnace of the chamber walls, which would tend to confine heat around the plant; and (4), when feasible, the furnace was best at an elevation above ground level, with a stage erected as furnace platform for the melters. This arrangement reduced the cost of removing slag, facilitated better attention to the tilting gear, and the space underneath the furnace provided warm storage for refractories underneath the stage, and avoided excavating for a transformer chamber. Electric furnaces were serviceable for any output of steel required from 10 tons per week upwards. A 5-ton furnace would yield 30 tons of steel per 24 hours; a 10-ton furnace up to 250 tons per week; and a 15-ton furnace 360 tons weekly. Mr. Stobie afterwards dealt in detail with the working of electric furnaces, explaining points which had been criticised, and advantages which improvements had realised.

The *Transactions* of the South African Institute of Electrical Engineers for January, 1919, contains the annual report and statement of accounts of the Institute for 1918. The income was £649, compared with £557 in the previous year, and the expenditure amounted to £449, against £429. Including bad debts recovered during the year there was a total surplus of £247, against £168. The credit balance now stands at £1,248. The total membership is 325. The Victoria Falls and Transvaal Power Co. has offered an annual award of £25 for competition for good work done by members of the Institute. The following officers have been elected for the years 1919 and 1920:—Vice-president, Mr. R. F. Botting; Members of Council, Mr. L. B. Woodworth, Mr. C. J. Everett, Mr. V. A. Bright, Mr. E. Grafton, and Mr. C. N. O. Dutton; Mr. G. A. Webb and Mr. P. E. Gregson have been elected Members of Council for the year 1919. The new President is Mr. A. E. du Pasquier, M.I.E.E., who was in England at the time of the annual general meeting on January 16th.

On Monday last, Mr. G. B. Williamson, chief engineer to Messrs. Horrockses, Crewdson & Co., Ltd., gave an address on "National Power Supply *versus* Private Plant," before the members of the Bradford Textile Society. He said that the actual consumption at the present time was below 3 lb. per H.P.-hour, and in the large spinning factories the consumption was rarely more than 2·25 lb. Ordinary private plant could be much more easily brought down to a figure approaching the ideal than could public stations, during the present generation, at any rate. The public supply system, from the point of view of the conservation of capital, appeared in an unfavourable light.

Society of Engineers (Inc.).—On Monday next, Prof. J. Young, of the Royal Military Academy, Woolwich, will give a lecture on "Modern Explosives," illustrated by specimens and experiments. The meeting will be held at the Geological Society's Rooms at 5 p.m., and ladies are specially invited.

"An Alternative to Electricity"?—A note appeared under this head in the *Times* last week, showing that the reference was to the "Sonic" system of transmission which is being developed at the Sonic Works, West Drayton, by Mr. G. Constantinesco, a Rumanian-born British naturalised subject. Great secrecy is maintained regarding his inventions, which include a successful synchronising gear for firing through the propeller of an aeroplane; it is stated that the Sonic system utilises wave motion (sound waves) in liquids enclosed in pipes for the purpose of transmitting mechanical effects, and it seems, therefore, more akin to the Bowden brake type of transmission apparatus than to anything electrical. The works, or rather laboratory, was provided by the Government to enable the inventor to carry on his work.

Exhibition of Electromedical Apparatus.—An exhibition, organised by the British Medical Association, is to be held at the Imperial College of Science and Technology, next week, from 9th to 11th April, at which X-ray and other electrical apparatus will be shown.

Copper Prices.—Messrs. F. Smith & Co. report April 2nd, electrolytic bars, £84; do. sheets, no change; do. wire rods, £94; do. H.C. wire, 11¼d. Messrs. James and Shakespeare report April 2nd, copper bars (best selected), sheets and rods, no change.

Appointments Vacant.—Electrical engineer and manager (£250) for the Borough of Morecambe Electricity Undertaking; switchboard attendant (67s. 6d.) for the Lancaster Corporation Electricity Works.

The City and Guilds Technological Examinations.—A series of conferences has been held between representatives of the Board of Education and the City and Guilds Institute with reference to the future of the examinations in England and Wales of the Institute's Department of Technology. At these conferences the Board's representatives have expressed the opinion that examinations by external bodies tend to interfere with the satisfactory working of the system of instruction in grouped courses of allied subjects, and that in so far as the Institute's examinations are external they conflict with the policy of the Board as regards technical education. The Executive Committee of the Institute has, therefore, endeavoured to meet the Board's views by some modification of its system of examinations, and ultimately an agreed scheme has been adopted.

Under this scheme the Institute has agreed to abandon gradually in England and Wales all examinations lower than the final, with a few specified exceptions. In 1919 the examinations will be held in all grades, as hitherto; in 1920, Grade I in all three-grade and two-grade subjects will be discontinued, but students who have passed in Grade I in a three-grade subject in a previous year will be able to proceed to Grade II; in 1921, the final examination alone, except in the few cases referred to above, will be held at all centres in England and Wales. The scheme also provides that marks are to be given for school work and for home work, and are to be taken into account in the examination results. This has already been put into force, and will tend to modify the external character of the Institute's examinations.

Although the Executive Committee of the Institute has consented to adopt the scheme, it retains its confidence in the value of its examinations synchronised with annual school courses, not only as giving incentives to students to work, but also as keeping up the standards of education in technical schools, and in a circular-letter addressed to local education authorities it expresses the hope that the abandonment of the lower examinations will not result in depressing the present standard of the Institute's final certificates, which have a recognised value in professional and industrial life.

It will remain as essential as ever that the syllabuses of the Institute should be kept up to date, and in close relationship with the courses of instruction in schools, and with the practical requirements of ever-progressing trade. With a view to this, the scheme contemplates the setting-up by the Institute of Advisory Committees in respect of the several examinations in technological subjects, on which Committees' teachers, as well as manufacturers and trade representatives are to be appointed, a policy which is fully approved in principle. This will entail considerable additional expenditure by the Institute.

The responsibility and expense of setting up or developing their own school examinations in lieu of the Institute's lower grade examinations will now fall on the local education authorities in England and Wales.

Mr. F. Peake Sexton, A.M.I.E.E., writes expressing the greatest regret that the City and Guilds Institute has decided to discontinue the majority of the Technological Examinations, at the instance of the Board of Education; at a time when all efforts should be exerted to develop our industries, it seems the Board of Education is adopting a policy that many regard as wrong. According to his experience, since the withdrawal of the Board of Education Examinations there has been a marked loss of enthusiasm for real study in the ordinary evening classes by the students, and even in some cases there has arisen a slackness on the part of the instructors. Mr. Sexton suggests that those who share his view should get into communication, and approach the City and Guilds and the Board of Education by petition. Every effort should now be made to develop our system of education.

Electroculture at Chester.—Mr. S. E. Britton, City electrical engineer, informs us that during the last growing season, the 1·4 acres of land on Overleigh Road equipped for electroculture was used on very much the same lines as in the previous year, and for the second season no manure or fertiliser was used.

The electrical equipment consists of an A.E.D. transformer, mercury-break current interrupter and Lodge valves, and the discharge network of No. 30 S.W.G. galvanised steel wire spaced 15 ft. apart, and suspended 2 ft. 6 in. from the ground; the network is raised as the crops grow to give a clearance of 2 ft. The apparatus is supplied with 5 amperes at 210 volts D.C., and maintains a spark ¾ in. long at any part of the discharge network when an earth wire is placed within that distance of it. When climatic conditions were suitable the discharge was used from two to four hours each day.

Owing to the long spell of dry weather during the early part of the growing season, and the abnormal quantity of rainfall when growth was nearing maturity, the season was unfavourable for electroculture.

The following seeds were sown:—

Four varieties of potatoes, peas, broad beans, French beans, turnips, swedes, onions, carrots, parsnips, beet, lettuce, cabbage, cauliflowers, savoy and brussels sprouts.

The carrots, parsnips, and swedes, did not germinate. The yield of the vegetables grown under the influence of the electrical discharge, as compared with those grown under natural control, was as follows:—

	Electroculture.		Natural control.	
	No. of roots.	Average weight per root.	No. of roots.	Average weight per root.
King Edward ...	701	·416	282	·613
Summit	2,739	1·01	1,467	1·26
Great Scot ...	3,575	1·87	589	2·4
Table Talk ...	337	1·8	122	1·84

that is, a decrease on each variety, namely, 32 per cent., 20 per cent., 22 per cent., and 2·2 per cent.

Peas gave an increased yield of 27 per cent.
Broad beans gave an increased yield of 6·8 per cent.
French beans gave an increased yield of 73 per cent.
Beetroot gave an increased yield of 88 per cent.

The other crops were not measured, but a marked difference was observed in the size of cabbage, cauliflowers, savoys, and sprouts, grown under the discharge, and these were freer from caterpillar, and ready for marketing two or three weeks in advance of those grown under natural control.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—The Southampton T.C. is recommended to increase the salary of the tramway manager and engineer (Mr. Robson) from £500 to £700 a year.

Burnley Tramways Committee, having considered the salary of Mr. Mozley (tramways manager), which is £500, plus a bonus of £75, has decided not to recommend an advance at present.

Southampton Corporation Electrical Committee has appointed Mr. H. S. Ellis, South Shields borough electrical engineer, chief electrical engineer, in place of Mr. H. F. Street, who has resigned, as already stated here.

Blackburn Electricity Committee has approved of the following increases in salaries: Deputy electrical engineer, from £429 to £500 per year; station superintendent, £7 5s. per week to £8 11s. 3d.; shift engineers, £5 to £6 3s. 3d.; switchboard attendants, £3 5s. to £4 5s. 11d.; meter and mains assistant, £4 12s. to £5 14s. 8d.; motor superintendent, £4 to £5 1s. 11d.; engineering draughtsman, £3 15s. to £5 12s. 7d.; street lighting superintendent, £3 17s. 6d. to £4 19s. 2d. The financial effect is to increase the salaries of the technical staff of the department by £800 per annum. A resolution to increase the salary of the tramways manager (Mr. Cowell) from £500 to £600 was deferred for a month.

The Controller of Coal Mines wishes to continue to retain the services of Mr. Rycroft, electrical engineer to the Heston and Isleworth U.D.C., as the work upon which he is engaged is of an important character in the national interest, but is willing to arrange for him to be free to devote one day per week to the Council's work. The Electricity Committee, however, desires Mr. Rycroft to resume his full duties as from March 31st, and has notified him of its decision and requested him to arrange accordingly. The Controller, in the course of his communication, had stated that in the present difficult conditions reliance had to be placed to such a degree upon Mr. Rycroft for carrying on an extensive organisation throughout the country that it would be out of the question for the department to part with his services at this moment.

General.—Mr. J. J. Butcher has been presented with a gold watch, by his friends in the winding and inspection department of the B.T.H. Co., Rugby. Mr. Butcher has been employed by the B.T.H. for over 16 years, and is leaving to take up another position.

Mr. W. J. Larke, O.B.E., who for 20 years has been one of the managers of the B.T.H. Co., at Rugby, has been offered by the Minister of Munitions an appointment in connection with the disposal of surplus stores, and the reorganisation of the Ministry on a peace basis. The appointment involves his resignation from the B.T.H. Mr. Larke was loaned to the Ministry of Munitions by the company in July, 1915.

Sir Henry Norman, M.P., has been appointed vice-chairman of the Imperial Communications Board, of which Viscount Milner is chairman.

Mr. A. Gibson, assistant for electrical work in the chief engineer's department of the L.C.C., has resigned his appointment.

Mr. W. J. Squires has been appointed chairman, and Lieut.-Commander A. Cooper Rawson vice-chairman, of the Highways Committee of the L.C.C.

Mr. C. E. Inglis, Fellow of King's College, and University Lecturer in Mechanical Engineering, has been appointed to the Chair of Mechanism and Applied Mechanics rendered vacant at Cambridge by the death of Prof. Bertram Hopkinson. The annual stipend of the professorship is £850, with £450 out of the receipts of the department.

Mr. H. Stilgoe, city surveyor of Birmingham, has been appointed chief surveyor of the Metropolitan Water Board at £2,500 a year. He has been in the service of the Corporation nearly 13 years; and during that time he has practically "town planned" Birmingham (40,000 acres), has prepared an elaborate scheme of road widening, and has been responsible for work connected with the electric tramway extensions.

Mr. John E. Raworth has been joined in partnership by Mr. Ernest W. Moss, A.M.I.E.E., A.M.I.Mech.E., F.C.S., who was for some years chief assistant to the late Dr. Silvanus P. Thompson, F.R.S., and was also an assistant to Mr. H. M. Hobart, M.I.E.E. Mr. Moss has had considerable experience in patent agency work, especially in connection with metallurgical and electrical inventions. The style of the new firm will be John E. Raworth & Moss, with head offices at Queen Anne's Chambers, Westminster, S.W.

Lieutenant J. A. Ogilvy has relinquished his commission in the Tyne Electrical Engineers on account of ill-health.

Second Lieutenant H. D. St. J. Lidiard, Tyne Electrical Engineers, who was appointed to the corps twelve months ago, has been confirmed in his rank.

Captain W. C. Thorne, Renfrew Fortress Engineers (Electric Lights Company), who was a supernumary whilst employed with the R.E., has been restored to the establishment of his corps. He got his third star in June, 1916, and prior to that was a temporary captain from the outbreak of the war, he being a pre-war officer of the corps.

Major G. A. Bruce, M.I.E.E., Tyne Electrical Engineers, who was employed as a temporary major in the Royal Marines (Submarine Miners) during the war, has been restored to the establishment of the corps. Major Bruce was commissioned in the Tyne Engineers over twenty years ago, got his captaincy in 1903, and his majority in 1915.

Captain and Acting-Major R. W. Anderson, M.C., Tyne Electrical Engineers, has relinquished his field rank on ceasing to be employed with the R.E. Captain Anderson was mentioned in dispatches and awarded the Military Cross for services in the campaign of 1916.

Mr. S. Simpson, electrical engineer with the Yorkshire Electrical Power Co., Thornhill, Dewsbury, has resigned his position, and on Saturday last the staff presented him with a mahogany desk and chair as a token of their esteem. A party of his more intimate friends entertained him to a dinner at Bradford, at which Mr. A. L. Lunn (president) and Mr. Ellis (chairman) of the Electrical Power Engineers' Association were present. Mr. Simpson has, after ten years' varied technical and commercial experience in the development of electric power supply in the West Riding and in power problems in textile mills, collieries, &c., joined Mr. J. E. Schofield, mechanical and electrical engineering consultant, Bradford, who has specialised in industrial power equipments and fuel economy.

Mr. S. R. Blades has been appointed as representative of the Aster Engineering Co. (1913), Ltd., of Wembley. He was for many years with Siemens Bros. Dynamo Works, Ltd., both at their Stafford Works and at the London Office. For the last year of the war he was an assistant engineer in the Anti-Submarine Division of the Admiralty.

Sir Ernest Rutherford was on Wednesday elected to the Cavendish Chair of Physics at Cambridge, in succession to Sir Joseph Thomson, O.M., who had held the chair for 35 years.

Obituary.—Mr. Henry Wilde, D.Sc., F.R.S.—We regret to record the death which occurred on March 28th, at his residence, the Hurst, Alderley Edge, Cheshire, of Mr. Henry Wilde. The deceased gentleman was 86 years of age, and therefore was probably unknown even by repute to a very large proportion of the present-day electrical fraternity. He was, however, undoubtedly one of the earliest pioneers in electrical engineering research and invention. Writing in the *Philosophical Magazine* 46 years ago, on "Some Improvements in Electro-Magnetic Induction (Dynamo) Machines," he foretold great applications by which the electromagnet "as a source of electricity is destined hereafter to live in the lives of the millions of mankind when the memory of its origin, except with the curious and the learned, shall be forgotten." He invented a process of electro-deposition of copper, a process carried on entirely with the vertical revolving mandrel, and following upon his patents many thousands of cylinders were manufactured and electro-coppered by well-known firms. He claimed to have invented the dynamo-electric machine in 1864, and his invention was utilised in searchlight work executed for the Admiralty; one report states that he made the first searchlight for battleship use. The death of Mr. Wilde recalls a controversy which arose in 1900 between him and the Society of Arts regarding the terms on which that Society proposed to confer upon him the Albert Medal. He took exception to the terms of the award because, while it gave him credit "for the discovery and practical demonstration of the indefinite increase of the magnetic and electric forces from quantities indefinitely small," it made no mention of his "invention of the dynamo-electric machine and its successful application . . . to electric lighting, and to electro-deposition of metals from their solutions." The Society eventually settled the terms as follows: "For the discovery and practical demonstration of the indefinite increase of the magnetic and electric forces from quantities indefinitely small, a discovery now used in all dynamo machines; and for its application to the production of the electric searchlight, and to the electro-deposition of metals from their solutions." Mr. Wilde subsequently presented the medal and copies of the correspondence betwen himself and the Society to the Institution of Electrical Engineers for deposit in the Museum and Archives. We also recall a controversy and action which took place between Mr. Wilde and the late Dr. Silvanus P. Thompson respecting credit alleged to have been omitted from an edition of one of his important works. Mr. Wilde was a member of the Court of Governors of the Manchester University, and a contributor and donor to the Manchester Literary and Philosophical Society. He was also an honorary member of the Institution of Electrical Engineers, and a generous contributor to its funds, the Wilde Benevolent Trust Fund, in particular, being established as the result of his beneficence.

Mr. G. H. Mann.—The death has occurred, at the age of 31 years, of Mr. George Henry Mann, head of the wireless department at the Central Technical School, Leeds.

Mr. Stephen Rusbridge.—The death has occurred, at the age of 88 years, of Mr. Stephen Rusbridge, who is described as the inventor of the method of electrical communication between passenger and guard, which has been employed on the L.B. & S.C. Railway over 40 years. According to the *Daily Telegraph*, Mr. Rusbridge was formerly in the service of the electrical department of the line, and had considerable experience in electric signalling in conjunction with Messrs. Saxby & Farmer.

Sir James Mackenzie Davidson.—On Monday last, Sir J. M. Davidson died at the age of 63, from heart failure. A noted surgeon and ophthalmic specialist in his early days, he came to London in 1897 and took up the study of X-rays, which were then coming into prominence, and became one of the foremost exponents of their applications to therapeutics and surgery. He was knighted in 1912, and, according to the *Times*, at the time of his death he was consulting surgeon to the X-ray Departments of Charing Cross Hospital and the Royal London Ophthalmic Hospital, and consulting radiologist to the military hospitals of the London district.

NEW COMPANIES REGISTERED.

Patent Electric Shot-Firing Co., Ltd. (153,782).—Private company. Registered March 21st. Capital, £10,000 in £1 shares. To take over the business of electric fuse manufacturers carried on by W. A. Malson, and S. R. Malson at Newbold, near Chesterfield, as the Patent Electric Shot-Firing Co. The subscribers (each with one share) are:—W. A. Malson, Salter Gate, Chesterfield; S. R. Malson, Knowsley Road, Southport, electric fuse manufacturer; J. R. Cooke, Gloucester Road, Chesterfield, electric fuse manager. The directors are to be appointed by the subscribers. Solicitor: W. E. Wakerley, Chesterfield, Derby.

Nene Engineering Co., Ltd. (153,923).—Private company. Registered March 29th. Capital, £10,000 in £1 shares. Electrical, mechanical, agricultural, and general engineers, dealers in and agents for cycles and motors, &c. First directors: J. H. Keeble, Charnwood, London Road, Peterborough, ironstone mine owner (chairman); R. M. Boothman, Thornfield, Hartford, Northwich, Ches., traveller. Secretary: A. J. Dillingham.

Dynelex, Ltd. (153,913).—Private company. Registered March 28th. Capital, £3,000 in £1 shares. Electrical, mechanical, motor, and general engineers, &c. The subscribers (each with one share) are:—H. J. Holmes, 6, Newcastle Street, E.C. 4, engineer; and R. G. Holmes, Sandilands, Surbiton, Surrey, clerk. Permanent governing director: H. J. Holmes. Registered office: 6, Newcastle Street, E.C. 4.

Marston, Billington, Ltd. (152,871).—Private company. Registered March 26th. Capital, £50,000 in £1 shares. Ironfounders, mechanical, and electrical engineers, boiler makers, lamp manufacturers, &c. First directors: A. M. Billington, Eden Works, Hayes, Middlesex; and H. W. Humphries, 23, King Street, E.C. 2, chartered accountant. Registered office: 23, King Street, E.C.

R. A. Evans, Ltd. (153,829).—Private company. Registered March 24th. Capital, £10,000 in £1 shares. Manufacturers of electric, hydraulic, and hand lifts, hoists, cranes, runways, and transports, electrical and hydraulic engineers and contractors, &c. First directors: C. Wells, Oak Lodge, Knighton Road, Leicester, manufacturer; F. A. Toone, The Lindens, Mountsorrel, hosiery manufacturer; J. A. Evans, 13, Mellor Road, Western Park, Leicester, electrical engineer. C. Wells & F. A. Toone are permanent governing directors. Registered office: Prospect Road, Leicester.

Motor Exchange and Mart, Ltd. (153,848).—Private company. Registered March 25th. Capital, £10,000 in £1 shares. Manufacturers of and dealers in electric, steam, gas, oil, or other motor vehicles, proprietors of self-starters for motor cars and aeroplanes, &c. The subscribers (each with one share) are:—J. R. Burton, Upcote, Hammers Lane, Mill Hill, N.W. 7; L. Waterhouse, 25, Gloucester Gardens, W. 2, gentleman. First director: J. R. Burton. Registered office: 30, Highgate Road, N.W.

Planet Electric Co., Ltd. (153,874).—Private company. Registered March 26th. Capital, £2,000 in £1 shares. Manufacturers of and dealers in electrical accessories and appliances, &c. First directors: H. Bennett, 56, Burton Road, Brixton, S.W. 9; W. Francis, 1, Lismore Road, Gospel Oak, N.W. 5, electrical engineer. Registered office: 5, St. George's Road, S.E. 1.

Prendergast Electrical Engineering Co., Ltd. (153,875).—Private company. Registered March 26th. Capital, £2,000 in £1 shares. Engineers, electricians, founders, &c. Agreement with J. F. Prendergast. Permanent directors: J. F. Prendergast, 155, Shaftesbury Avenue, W.C., electrical engineer; Capt. N. J. Walker, 14, North Audley Street, W. Registered office: 108, Wigmore Street, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Power Engineering Co., Ltd.—Particulars of £11,500 debentures created February 15th, 1919, of which £2,000 were issued on March 6th, charged on the company's undertaking and property, present and future, including uncalled capital.

Newquay Electric Light & Power Co., Ltd.—Particulars of £1,000 third mortgage debentures created, and all issued, March 4th, 1919, charged on the company's undertaking and property, present and future, including uncalled capital.

Westinghouse Electric Export Co. (1,707F).—Particulars of the Westinghouse Electric Export Co. were filed at Somerset House on March 26th, pursuant to Section 274 of the Companies (Consolidation) Act, 1908. The company was incorporated in the State of Delaware, U.S.A., on April 21st, 1915, with an authorised capital of $100,000 in $100 shares. The principal office is at Wilmington, New Castle, Delaware. The British address is 2, Norfolk Street, W.C.2. F. B. Rogers, of 1a, Edith Road, West Kensington (European manager), is authorised to accept service of process and notices.

Evans, O'Donnell & Co., Ltd.—Satisfaction to the extent of £3,000 on December 31st, 1918, of trust deed and supplemental deed dated 1900 and 1916, securing £40,000 debenture stock.

Cosmos Engineering Co., Ltd.—Particulars of £54,000 fourth mortgage debentures created November 19th, 1918, issue January 28th, 1919, charged on the company's undertaking and property, present and future, including uncalled capital.

Bastian Electric Co., Ltd.—Land Registry Charge on 47, Stamford Hill, N., dated March 6th, 1919, to secure £900. Holder: J. W. F. Graham, 29, Gracechurch Street, E.C.

S. C. C., Ltd.—T. M. Till, of 28, Bucklersbury, E.C., was appointed (*a*) on March 7th, 1919, as receiver of the premises charged by debenture dated September 5th, 1918, and (*b*) on March 14th, 1919, by the Court as receiver of the personal property, goodwill, and assets under debenture dated November 11th, 1918.

Montreal Tramways & Power Co., Ltd.—(*a*) Particulars have been filed of £1,500,205 10s. ($7,300,000) five-year 6½ per cent. secured gold bonds, created February 10th, 1919, and all now issued at 92 per cent. Property charged: $7,000,000 aggregate par value of the fully-paid 5 per cent. mortgage debenture stock of the Montreal Tramways Co., and $2,500,000 of five-year 6 per cent. gold bonds of the company, dated March 1st, 1919. (*b*) Particulars have also been filed of £513,769 ($2,500,000) five-year 6 per cent. gold bonds, created February 10th, 1919, and all now issued at 92 per cent. Property charged: 21,000 shares of $100 each par value in the common stock of the Montreal Tramways Co. Trustees for both series: The Montreal Trust Co.

Yorkshire (West Riding) Electric Tramways Co., Ltd. (84,167).—Capital, £800,000 in £5 shares (70,000 pref. and 50,000 ord.). Return dated February 14th, 1919. 46,261 pref. and 40,977 ord. shares taken up; £436,190 considered as paid. Mortgages and charges: £272,373.

CITY NOTES.

Brompton & Kensington Electricity Supply Co., Ltd.

At the annual meeting, on March 27th, the chairman said that having regard to the position which the company had achieved, last year's working was the worst in its history. The net receipts fell to the figure of twenty years ago, though the gross receipts were double what they were then. This result was in spite of the fact that they had gradually raised the price until they were charging lighting consumers the maximum rate authorised by the provisional order. The revenue was reduced by various restrictions, and the expenses were increased by the statutory advance of wages, so that the labour bill amounted to double what it was before the war, and equalled in amount the entire net revenue, or nearly half as much again as the dividend to be distributed on the entire ordinary capital. Moreover, the same cause was responsible for the increase in the cost of coal, and as if to add to their difficulties, the Coal Controller diverted their coal contracts in favour of less provident undertakings, so that they were compelled to accept delivery of coal of vastly inferior calorific value, involving the handling of a larger tonnage, and resulting in a coal cost of 16 per cent. more on an output of 8 per cent. less, or an increased total cost per unit of upwards of 30 per cent. They had been unable to obtain any redress for the hardships suffered at the hands of the Government. For the greater convenience of the collieries and the railways, they were asked to provide themselves in summer with a large part of the coal they required in winter, but the response they made to the appeal brought advantage only to others, and although they applied for relief under the Statutory Undertakings (Temporary Increase of Charges) Act, 1918, and submitted an estimate of the loss they would sustain if such relief were withheld—which was absolutely justified by the event—the rhetorical representations of the local authority and the London County Council, which were entirely prejudiced and uninformed, prevailed with the Board of Trade, and if the company had not received interest on its loan to the Accessories Co., and trenched upon the balance brought into the accounts from the previous year, the action of these sapient authorities would have reduced their dividend by upwards of 40 per cent., although Parliament expressly decided that it would be reasonable to reduce the losses of ordinary shareholders in such undertakings as theirs whose financial position was adversely affected by circumstances arising out of the war to 25 per cent. of the pre-war rate. Restrictions were gradually being relaxed, and the revenue for the current year already showed some signs of recovery, but the industrial position remained very unsettled, and any reduction in their expenditure must necessarily be slow to ensue. The past year had brought the renewed confirmation of the wisdom of their "accessories" policy. The Accessories Co. was not only a good customer and a good advertisement, but was a growing source of profit. The electrical industry generally was in a critical stage, and in view of the many projects which were being advanced, it was impossible to say what the future of the Metropolitan companies might be in the industrial reconstruction which was now in contemplation.

Hastings & District Electric Tramways Co., Ltd.

Presiding at the recent annual meeting, Mr. George Kitchin referred to the big advances in wages of motormen and conductors since 1914. They were awaiting the result of deliberations respecting the 44-hour week proposal. They had to cut off the Sunday traffic last year owing to the Government orders to reduce coal consumption by 15 per cent. That meant a reduction of £150 to £300 per week revenue, according to the season. Petrol, which in 1914 cost under 11½d. per gallon, to-day was costing 2s. 5½d., while coal, which in 1914 was charged at 19s. 6d. per ton, was now charged at 35s. or thereabouts, and that for slack coal. Meanwhile, gear wheels had risen in price 348 per cent., pinions 450 per cent., tires 216 per cent., armature coils 245 per cent., tickets 400 per cent., rails 197 per cent., and so on throughout the whole long list of materials required to keep the lines in going order. With the demobilisation of the armies and the return to greater freedom of movement which must follow on the final conclusion of peace, it would become possible to restore not only the Sunday traffic, but also the other services which they had had to curtail owing to the war. Coal, petrol, and other materials must gradually resume more normal prices, though it was not to be expected that they would fall to as low a level as that of 1914. Still some not inconsiderable relief could be looked for in that direction. But wages—well, they could judge what prospect there was of any reduction of that item. In restoring the services they would have to restore also the number of their employés; and every motorman added to the staff meant an addition to expenses of £150 to £170 a year at the least. There was, however, grave reason to fear that the traffic receipts, which had been steadily rising throughout the period of the war, would now take a turn in the other direction. The large number of soldiers now at Hastings would probably be, to a considerable extent, demobilised; while the opening of the eastern coast resorts, and, eventually, of the Continent, to holiday traffic, must have an injurious effect on the number of visitors to Hastings. Meanwhile, they were still, in combination with other tramway interests throughout the country, endeavouring to get Parliamentary sanction to an increase of the fares as fixed by statute and agreement.

British Columbia Electric Railway Co., Ltd.

The report for the year ended at June, 1918, states that the net revenue shows an improvement of approximately £42,000 over the previous year. This has enabled the payment of the full 5 per cent. dividend on the cumulative preference stock without recourse to the reserve fund. For the previous year it was necessary to take £44,000 from the reserve fund to make this payment, and for the year ended June 30th, 1916, £70,000. In June, 1918, a demand was made by employés for a large increase in wages, which in view of the condition of the company's earnings it was quite impossible to concede. The matter was referred to arbitration, but early in July a serious strike took place which paralysed the tramway services. In order to put the company in a position to meet the demand and thus resume the services, the authorities granted the company the right for a period of nine months to charge a six cent fare in the city of Vancouver, and to make certain increases in the fares in other cities and districts served. These increases in fares, the continued general improvement in conditions, and the increased demand for power for manufacturing purposes have enabled the company to meet the increased cost of wages and materials, and gradually to improve its net revenue month by month during the current year. On the other hand, the directors call attention to the fact that the right to charge the increased fares expires on April 8th next, and has not as yet been extended. The rates for domestic light and power in the city of Vancouver were reduced on January 1st, 1918, to 8 cents per KW.-hour, and in consequence of urgent representations of the public authorities and as part of arrangements for adjusting the general situation, these rates were again reduced by the company on January 1st last to 6 cents. It is as yet impossible to state with any accuracy what the cost to the company will be of this large reduction in lighting rates, but it must for some time cause a very considerable decrease in the revenue derived from domestic lighting, although it is hoped that the reduced price will, in course of time, lead to a substantial increase in the consumption of light and power. The Government of the Province of British Columbia has introduced a Bill to establish a Public Service Commission, conferring upon the Commissioners very far-reaching powers over this enterprise and all other public utilities in the Province.—*Financial Times.*

British Engine Boiler & Electrical Insurance Co., Ltd.

Interim dividend 5s. per share, paid last July. Final dividend 8s. 6d. per share and the usual bonus of 4s. per share, all less tax.

At the annual meeting, held at Manchester last week, Mr. R. C. Longridge, who presided, said that during the year there had been a substantial growth of £32,735 in the income of the company, raising it from £148,472 to £181,207, but the increase in the cost of claims, in inspection charges, and in other liabilities, had fully kept pace with this growth. Electrical plant, in the insurance of which the company specialised, had contributed a substantial proportion of the increased income, and the prospects were that there would be continued and rapid developments in the use of electrically-driven machinery. The large interest which the company had in the insurance of electrical plant of all descriptions had necessitated the employment of specially trained engineer surveyors located at convenient points throughout the country, in order that they might be readily accessible for the periodical inspection of insured plant and for dealing promptly with breakdowns. In recent years the insurance of power plant had become more hazardous than formerly. The steam turbines and gas engines in use now were often much larger than any that were met with a few years ago, but reliability had not kept pace with the development in size, so that accidents were relatively more numerous and infinitely more costly. This aspect of the case was being brought home to public authorities and those responsible for electrical generating stations, with the result that they were showing more inclination than formerly to pay for the inspection and insurance of their power plant. The increase in the size of machines had led to some demand for insurance against damage to surrounding property which might be caused by the disintegration of heavy machinery running at high speeds. Apart from the increase in hazards there had been a heavy increase in the cost of all repairs during 1918. In many cases the charges of engineers had risen as much as 150 per cent. over pre-war cost. Incidentally this very feature had caused firms to look favourably on the question of insuring their plant.

British Aluminium Co., Ltd.

The annual meeting was held on Friday last. Mr. A. W. Tait, who presided, said that the profit, after making provision for excess profits tax, amounted to £420,426, as compared with £423,662. The trading profit was £351,697, a decrease of about £17,000. On the other hand, interest and dividends showed an increase of £16,500. The trading for the whole period was under Government control, and the results were not so good as those of the previous year. That was due to a reduction in price as well as to further increased costs of production at their works both at home and in Norway. The output had been the largest in the company's history, and the demand for their productions for war purposes were heavy. The company had rendered great service in the supply of an essential metal which was urgently required for many purposes, particularly for explosives and aircraft. There had been a rapid increase in production of aluminium throughout the world, especially during the period of the war, to meet the great demand, and that increase had been considerable in Norway and America. The whole of that production was urgently needed during the period of the war, but the sudden stoppage of hostilities caused serious dislocation in the industry. The effect of the armistice was the immediate cancellation of large numbers of orders, with the result that large stocks had accumulated, not only in this country, but abroad. There was also a natural hesitancy on the part of buyers to make forward contracts due to the uncertainty and difficulty of getting industry restarted in its ordinary channels. It was necessary to take immediate steps to meet those conditions by curtailing production as far as possible to the approximate demand. That had been done in this country and in other countries where aluminium was produced, and with a view to encouraging demand there had been a substantial reduction in price. The demand depended upon the general requirements of industry. Unfortunately the resumption and development of peace production was greatly hindered by the general uncertainty which existed with regard to labour, the irksome restrictions which still remained in some measure in regard to exports, and by the shortage of freight. In view of the valuable concessions which labour had obtained with regard to hours and rates of wages, he hoped it would soon settle down to give the requisite production to justify those concessions, and that trade would rapidly begin to develop so that the country might be able to carry the enormous burden with which it had been saddled in consequence of the war, and the social and economic schemes which were urgently required for the betterment of the country might be put in hand at the earliest possible moment. The question of the aluminium industry was somewhat complicated by the fact that at the present moment there were large stocks of metal in the hands of the Government. It was necessary for reasons of national safety that those stocks should have been carried during the war, but now the war was finished it was equally necessary that those stocks should be realised. The Government, however, appreciated that it would be bad business to throw those stocks upon an unwilling market, as that would have the effect of breaking prices, and bringing the selling price considerably below the cost of production. That would do serious injury to what had been admitted to be a "key" industry. The Government therefore had made arrangements whereby the stock they held would be gradually disposed of as the demand for the metal increased, in a manner which would not unduly affect the position of the industry in this country. Although the present conditions were difficult, he was of opinion that if industry could resume its normal proportions it would not be long before they saw improvement, because the developments which took place in the demand and uses for aluminium previous to the war were of a most encouraging nature, and much progress had been made since in consequence of the war. Therefore, although to-day there was a large surplus capacity of production throughout the world, he hoped that within a reasonable period of time not only would that be taken up, but that it would be necessary still further to increase production in order to supply the demand. The future for the metal was bright when they considered the large demands which must in time be made, in consequence of the development in the motor, chemical, electrical, and aeroplane industries, and for domestic utensils, and other commodities for which it was eminently suited, in addition to the demands which had been and would continue to be created by research work in connection with alloys, in which aluminium played an important part. The costs of production during the year had shown substantial increases over those of the previous year, and he thought it would be some considerable time before costs were substantially reduced. On the other hand, prices had been substantially reduced in order to re-establish the demand for the metal. Referring to the Bill which the company promoted in the House of Lords last year for the development of a large water-power in Scotland, which was withdrawn on second reading owing to opposition which certain of the provisions met with, the chairman said that the scheme was supported by the Board of Trade and other Government departments. The matter was still under consideration, but no definite decision had been taken as to future action, as that would depend largely on the Government's attitude and policy with regard to hydroelectric development. In that connection, a Government Commission had been appointed to investigate the resources of the country in that respect, which had just issued an interim report. Having referred to the figures in the balance sheet, the chairman, in conclusion, said that while their industry, like all other industries of the country, was going through an anxious time in consequence of the change over from war to peace conditions, he hoped and believed that that period of change would be comparatively short. In a large measure, however, that would depend upon the Government realising the importance of releasing industry from all unnecessary restrictions, and doing everything in their power to increase the supply and reduce the price of the necessary commodities of life. The urgent question of housing should also be tackled without delay.

Newcastle-upon-Tyne Electric Supply Co., Ltd.

At the annual meeting, on March 25th, Mr. J. H. Armstrong, the chairman, said that the labour unrest resulting in stoppage of works within their area, naturally had reduced to an extent the profits of the year, as their heaviest load was during the last two months of the year. Their trading results during the past year had already been affected by the many increases in salaries and wages which had been thrust upon them by the Committee on Production, or as the result of Government awards to assist in meeting the increased cost of living, which, in one manner and another, resulted in an increased cost, as compared with the previous year, of more than £54,000. The restricted use of light and heat, the consequence of the Household Fuel and Lighting Order, and the restrictions in connection with new supplies to private houses, had also had an adverse effect. Taking these drawbacks into account, and the enhanced cost of coals and materials generally, they ought to be satisfied with the results of the year. The total war increases in salaries and wages during 1918 represented £103,214, or an increase of 106 per cent. upon what was paid in 1914. Their transfer to plant and renewals and improvements account was £20,000 less than in the previous year, as they did not think they would have so large an expenditure on this account as they had had in the previous year; and, further, they would be able to make use of their newer and more economical generating plant, instead of having to rely upon the older stand-by stations to meet a portion of the load. Last year they hoped that Carville station would have been completed by the end of 1918. Owing to delays, however, it was not now expected that the station would be completed until the latter part of the current year; they had had, however, the use of a considerable portion of the plant, boilers, &c., throughout the greater part of the past year. Unless anything unforeseen arose, it was hoped that a portion of the New Tees power station might be running towards the late autumn, and that the remainder would be in operation by the middle of next year. The total capacity of the three main power stations, when the developments in hand were completed, would be: Carville, 124,000 H.P.; Dunston, 96,600 H.P.; and Tees, 53,000 H.P.; a total of 273,600 H.P. Reference was made in the report to the further issue of share capital amounting to £500,000 in October last, and he was glad to say that the total applications considered amounted to £1,189,444, which showed the opinion of the public as to the soundness of the

company. In regard to the Cleveland Co., the results had been far from satisfactory, owing to the heavy charges in the shape of war increases of salaries and wages, and also to the very high prices ruling for coal consumed in its uneconomical power station. Although 7,113 additional H.P. was connected during the twelve months, and the increase in units sold to consumers amounted to 3,228,000, the profits for the year (subject to audit) were only £26,788, as against £38,779 in the previous year, the result being that whilst last year the company was able to divide 2 per cent. on its preference shares, as a contribution to the Newcastle Co.'s profits, the surplus for this year, after discharging the interest on the debenture debt, was insufficient to justify a payment being made on the preference capital. They would remember that when dealing with the proposed exchange of shares with the Cleveland Co., at the meeting in March, 1917, reference was made to the difficulties under which that company was labouring as a result of the war, owing to the falling off in the supply of current from waste heat stations, and owing to its only possessing a small and uneconomical coal-fired station from which to obtain the remainder of its requirements. It was for those reasons that the new Tees station, a portion of which was approaching completion, was contemplated as part of the Cleveland development scheme that was to produce current at the lowest possible cost. The coming into operation of this station would enable material economies to be effected, and the results of that district would be further improved if, and when, the supply from waste heat stations approximated that which was received before the war. The question of electric power supply was being specially considered by Parliament, and it was probable that in a very short time there would be some definite statement as to the action which the Government intended to take under its proposed scheme of control. The board of the Newcastle Co. had no further information as to what was likely to happen in the event of the measure receiving the consent of Parliament, but he thought that under any circumstances it was not likely that they would be disturbed, or prejudicially disturbed, for some time to come. It must be borne in mind that the object that the Government was aiming at was based, to a large extent, upon the policy that that company had been following for a period of years, and which had resulted in them acquiring and bringing under one control the power supply of a number of smaller companies, which, on account of their limitations, were not able to run economically and profitably. It would seem likely, therefore, especially after the reference which was made in the report of the Parliamentary Committee to the developments in, and the working of, their area, that they might be asked to carry on without any change other than that which might be necessary both in the interest of the Government and of that company, and which would be provided for under the proposed Government control. Under those circumstances, he did not think they need expect anything but fair treatment from the new department, which was only what the company was entitled to receive, having regard to the development work which had been undertaken within their area. It was difficult, owing to the great uncertainty of what was likely to happen during the next few months to make any forecast of the future, so much depended upon the effect which labour unrest might have in delaying contemplated developments. They had also had a temporary drop in load due to the cessation of the manufacture of munitions, which had been considerable, and further, they were still faced by increased costs. Against those adverse factors they had the encouraging facts that the actual applications for additional supplies on hand at present amounted to no less than 65,000 H.P., of which 28,000 H.P. represented further supplies required in the Middlesbrough area. These additional connections, when made, would considerably more than counteract any reduction in the load due to the curtailment of the munitions manufacture, but the rate at which they would be made must depend to some extent upon the settlement of the labour problems with which the country was now faced, and must, in any case, take considerable time. He thought that, however uncertain the outlook might be, they could look forward with confidence to the future, once the transition stage was passed.

Dr. J. T. Merz seconded.

Mr. Gemmell criticised the absence of detail in the balance sheet. There was, as had been stated, no return from the Cleveland Co., which represented £800,000 of capital and more, and this, he thought, did not reflect credit upon taking over the company. Mr. Gemmell was referring to a pamphlet he had published.

When Mr. W. H. Knowles, a shareholder, interrupted, and asked for a show of hands by those who resented Mr. Gemmell's remarks, and some were held up, but the majority of those present did not vote.

The Chairman said Mr. Gemmell seemed to have a grievance, but he did not know what it was.

Stock Exchange Notice.—Application has been made to the Committee to allow the following to be quoted in the Official List:—

Telegraph Construction & Maintenance Co., Ltd.—37,350 additional shares of £12 each, fully paid, Nos. 37,351 to 74,700.

New Issues.—An issue of 7 per cent. cumulative preference shares is now being made by the Midland Electric Corporation for Power Distribution, Ltd., to provide additional working capital. Subscriptions are invited for 40,000 preference shares of £5 each at par. These shares include the 13,079 subscribed for by the British Insulated & Helsby Cables, Ltd.

The Electric Construction Co., Ltd., is offering to the shareholders 75,800 ordinary shares of £1 each at 2ls. 6d. per share, and the proceeds are to be devoted to extensions to the works and plant at Wolverhampton, and other purposes.

The Anglo-Portuguese Telephone Co., Ltd., is offering to existing share and debenture holders an issue of £50,000 5 per cent. extension debenture stock (free of income tax up to 6s. in the £) at the price of 101. The stock is offered *pro rata* to existing holders in the proportion of £1 of stock in respect of every £4 of shares or stock now held. The issue is underwritten. The prospectus states that the complete figures of the business for the year 1918 are not yet available, but it is known that both gross and net income exceed the 1917 figures. Now that the war is over the difficulties lately experienced in procuring plant, machinery and accessories for keeping pace with the normal demand for service are expected to disappear; 1,000 new subscribers are now waiting to be connected up. The present issue is being made for the purpose of providing the wherewithal to carry out these necessary extensions.

Shawinigan Water & Power Co.—The gross earnings for the past year amounted to $3,621,074, an increase of $718,864 compared with the preceding year, and the net revenue to $1,410,093, an increase of $59,229. The various companies owned and operated by the Shawinigan Co. had a satisfactory year, although the increased expenses absorbed the slight increases which were made for power and lighting. 1,058,127,769 units were generated during the year, an increase of 12 per cent., and additional power was purchased from the Laurentide Power Co. The directors estimate that work on the development of the Gres Falls will be commenced in 1920, and will take two years to construct; the Falls will produce about 100,000 H.P.—Canadian *Electrical News*.

Dividend at the rate of 7 per cent. per annum for the past quarter.

Compania Andina de Electricidad Sociedad Anónima.—The directors have recommended the payment of a dividend of 10½ per cent. for the year 1918. The available balance was $203,462. $10,000 is credited to the depreciation fund; $5,000 to the issue of obligations account; $10,173 to the legal reserve fund; $9,331 to the board and syndic; $168,000 to the payment of dividends; and $958 is carried forward. In spite of increased working expenses, the result was satisfactory. Owing to the exceptional shortage of water power, the thermic power house had to be used almost continuously for several months. An abundance of water is anticipated during the present year, and already the price of fuel is falling. The Compañia Electrica del Sud, in which the company holds considerable interests, is progressing satisfactorily, and the results for the year 1918 will probably be similar to those of the preceding year.—*Review of the River Plate*.

Bristol Tramways & Carriage Co., Ltd.—Revenue for 1918, £749,873; working and general expenses and renewals, £634,776; net revenue, £133,249; debenture and other interest, £22,666; interest on uninvested reserve, carried to reserve, £6,634; 4 per cent. preference dividend, subject to tax, £14,250; 7 per cent., free of tax, on the ordinary shares, £35,000; to reserve for contingencies and renewals, £40,000; carried forward, £14,700. The receipts of the tramways department show a decrease of £467, and those of the carriage department an increase of £105,670. Passengers carried on cars and motor omnibuses 61,813,124, a decrease of 2,168,651. The corporation obtained a further order from the Board of Trade extending the time for exercising its option to purchase the tramways undertaking to October 31st, 1919.

Lanarkshire Tramways Co.—Revenue for 1918, £192,530; expenses, £126,050. Contributions to local authorities, £6,271; debenture and other interest accounts, £5,143; reserve for depreciation, £12,000; maintenance reserve, £7,600; balance brought forward, £3,207. Dividend on shares, 9 per cent. for the year; to directors, £1,892; carried forward, £5,912. Revenue increase, £40,095 expenses increase, £32,077. Owing to labour and materials difficulties it has been impossible to maintain the undertaking in the usual state of repair, and the £7,600 transferred to maintenance reserve is for repairs to be undertaken after the war. Passengers carried 31,695,400, against 27,570,046 in 1917. Average fare 1.45d., against 1.31d. Mileage 2,508,434, against 2,435,508.

London Electric Wire Co. & Smiths, Ltd.—Five per cent., less tax, on ordinary shares for half-year, making 7½ per cent. for the year. £10,437 carried forward.

According to the *Financier*, it is proposed to capitalise £322,035 of the reserve by the issue to ordinary shareholders of 64,407 ordinary shares of £5, credited as fully paid, in the proportion of one new share for every share held; the new shares ranking for dividend as from January 1st, 1918.

Winnipeg Electric Railway Co.—Net operating revenue for 1918 $1,176,496. Interest on debenture stock, &c., being deducted, the net income stands at $289,784; depreciation $201,050. Balance $88,734, plus $1,214,131 brought forward. Surplus carried forward $1,242,865.

Reading Electric Supply Co., Ltd.—Net revenue £13,572, against £10,573. £4,500 to depreciation; dividend, 4 per cent.; carried forward, £1,004.

Bell Telephone Co. of Canada.—Two per cent., less tax, for the past quarter.

Doulton & Co., Ltd.—Five per cent., less tax, on preference shares for the year 1917.

STOCKS AND SHARES.

TUESDAY EVENING.

GENERAL improvement in gilt-edged securities has led to a firming-up of the tone throughout the Stock Exchange. What apprehensions there were of dearer money have given place to a more hopeful feeling in regard to the money market. The Budget prospect displeases. Talk of a seven-and-sixpenny Income Tax does not tend towards cheerfulness. But even in income-tax matters the Stock Exchange has shown itself an extremist in times past, and its members delight to say that they hope for the best while they prepare for the worst.

Labour difficulties are less pressing, therefore less depressing. Industrials have begun to attract attention again. The few luckless wights who receive the same pay for their work as they did prior to the war may join with the investor in bewailing the heavy increases granted to others, but the latter reck naught of that, and each conceded demand whets the appetite for more. Home Railway stocks are mildly better on the temporary settlement in the world of railwaymen, though changes in price are of no consequence. British Electric Tractions are heavy again, the ordinary shading off to 45¼. British Electrical ordinary stock has further hardened to 82, and there is little enough to be obtained at that price.

"Summer-time," cum frost, snow, and biting winds, makes a poor advertisement for electricity supply shares. The market is a quiet one. Ex dividend markings have brought in no new buyers. At the Brompton & Kensington meeting the other day, the chairman dealt lengthily with the hardships under which supply companies are labouring as a direct result of Government actions. The coal position is admittedly grave. In some directions, however, affairs are getting better. The return of men from the Services will make its beneficial effect felt more and more as time goes on, though here, again, the Government have thrown a superfluous—not to say a scandalous—handicap upon industry by their lavish extravagance in the matter of unemployment allowances.

The investor has no cause to complain that he does not know what to do with his money. New issues are receiving favourable consideration. The underwriting for the preference shares of the Midland Power Distribution Co.—the prospectus of which is now published—was taken eagerly. Numbers of newcomers are in course of preparation for the public, and before long there will be a rush of prospectuses, thanks to the raising of the Treasury's restrictions upon the offer of shares in domestic companies.

The report of the Waste Heat & Gas Electrical Generating Stations shows a reduction of about £2,600 in net profit, which comes out to £26,100 for last year, but the dividend is maintained at 8 per cent., the same as that for each of the past eight years. The Automatic Telephone Co. has declared a dividend of 6 per cent., and the shares have risen to 31s. 6d. The reason for the rise is due, however, to the strong hope that automatic telephoning may be adopted by the Post Office for the whole system. Apparently the chief reason for its not being put in hand at once is the expense that would be involved in making the change, but such a trifle would surely not be allowed to stand in the way, according to a sarcastic jobber in the market, of the present Administration. Marconis remain a firm and active market, and in their case expectation fastens upon the idea of either a big dividend or a substantial bonus—or both—to be declared shortly by the International Marconi Marine Co. The shares in the latter have gone up to 4 7/16, and Canadian Marconis to 16s., Americans remaining at a shade below 30s.

It goes without saying that the Stock Exchange is watching with the keenest interest the developments in connection with the Water Power Resources Committee, whose report, just issued by the Board of Trade, is regarded as a live contribution to the interests of the country. To utilise water power on a much bigger scale than ever before attempted has for many years past been a favourite dream of Stock Exchange men practically acquainted with electrical schemes, and at last it appears as though something were actually going to be done in this direction. The Canadian and American undertakings formed for this object have been on the whole successful, and have absorbed a good deal of British money. It is urged that the same idea can just as well be worked out on this side of the Atlantic, to the saving of coal, and the profit of water-power projects.

British Insulated shares have given way to 1½, which is ex dividend, apparently on some disappointment that the meeting did not produce a more optimistic speech from the chairman. British Westinghouse preference have firmed up to 2½. Siemens have had a smart rise of 12s. 6d. to 6¼, on various favourable rumours, one of which deals with the possibility of a share-splitting scheme, while another hints at amalgamation with some similar company. It is rather interesting to recall that Siemens shares were sold some time ago to a financial group, by the Public Trustee, at a price said to be about £3 5s. per share, rather less than half the present quotation.

Dealings have begun in the ordinary shares of the English Electric Co., and the price is 26s.-27s. The company owns all, or practically all, the shares of Dick, Kerr, the Coventry Ordnance Works, the Phœnix Dynamo Manufacturing and the Willans & Robinson Companies. The properties are stated to have a total area of 172 acres. Electric Constructions are not quite such a good market at 25s., the price having weakened a little in consequence of the offer to existing shareholders of about 76,000 ordinary shares at 21s. 6d., the latter price being ex the dividend of 1s. a share, which the old will receive. Naturally, this involves a turn to those who can sell the old at the market price and take up the new shares. There is nothing much doing in the rubber market, and the base-metal issues remain somewhat dull. The armament group is steady, though Vickers are slightly easier, owing to the dividend announcement not yet having made its appearance.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1917.	Dividend 1918.	Price April 1, 1919.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	10	8	7½	—	£5 8 0
Charing Cross Ordinary	4	4	8¼xd	—	5 14 4
do. do. do. 4½ Pref.	4½	4½	8¾	—	6 13 4
Chelsea	5	5	8½	—	4 1 1
City of London	8	8	11¼xd	—	6 14 8
do. do. 6 per cent. Pref.	6	6	102xd	—	6 0 0
County of London	7	7	103xd	—	6 11 0
do. do. 6 per cent. Pref.	6	6	97xd	—	6 3 1
Kensington Ordinary	7	6	54xd	—	5 2 2
London Electric	Nil	Nil	1½	—	Nil
do. do. 6 per cent. Pref.	6	6	85	—	7 14 10
Metropolitan	4	5	8½	—	7 13 10
do. 4½ per cent. Pref.	4½	4½	8½	—	6 18 8
St. James' and Pall Mall	9	10	7½	—	7 0 4
South London	5	5	25xd	—	5 19 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	9	8	6¼	—	8 0 9
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. T l, Pref.	6	6	20½	—	6 0 7
do. Def.	1½	33/6	21½	—	7 13 0
Chile Telephone	8	8	7¾	— ¼	5 8 8
Cuba Sub. Ord.	7	7	11	—	*3 7 4
Eastern Extension	8	8	16	—	*5 0 0
Eastern Tel. Ord.	8	8	161½	—	*4 19 0
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 7
do. do. Pref.	6	6	105	—	5 14 8
Great Northern Tel.	22	22	275	—	8 16 8
Indo-European	13	13	87½	—	5 18 8
Marconi	20	20	4⅝	+ 1/16	4 2 0
Oriental Telephone Ord.	10	15	3¾	—	4 0 0
United R. Plate Tel.	8	8	7¾	—	*5 1 7
West India and Panama	1/3	1/3	1½	—	*3 15 0
Western Telegraph	8	8	182xd	—	*4 15 10
HOME RAILS.					
Central London Ord. Assented	4	4	62½	—	6 8 0
Metropolitan	1	1½	26½	— ¼	4 14 7
do. District	Nil	Nil	21¼	—	Nil
Underground Electric Ordinary	Nil	Nil	8¼	—	Nil
do. do. "A"	Nil	Nil	9/8	—	Nil
do. do. Income	4	5	94½	— ¼	*5 5 10
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	43	—	6 11 4
Anglo-Arg. Trams. First Pref.	5¼	Nil	8½	— ¼	—
do. do. 2nd Pref.	—	—	8½	—	—
do. do. 5 Deb.	5	5	66¼	—1	7 10 5
Brazil Tractions	—	—	55⅝	—	—
Bombay Electric Pref.	6	6	104	—	5 11 7
British Columbia Elec. Ry. Ptcs.	5	5	63	—	8 0 0
do. do. Preferred	Nil	Nil	41	—	Nil
do. do. Deferred	Nil	Nil	41	—	Nil
do. do. Deb.	4½	4½	61	—	6 19 4
Mexico Trams 5 per cent. Bonds	Nil	Nil	61	—	Nil
do. 6 per cent. Bonds	Nil	Nil	82	—	Nil
Mexican Light Common	Nil	Nil	37	—	Nil
do. Pref.	Nil	Nil	51	—	Nil
do. 1st Bonds	Nil	Nil	67	—	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	23	+ 1/16	4 0 0
British Aluminium Ord.	10	10	1¹⁵/₁₆	—	5 12 6
British Insulated Ord.	25	19½	17½xd	— 1½	6 13 4
British Westinghouse Pref.	7½	7½	2½	+ 1/16	6 3 0
Callenders	25	25	10	—	6 5 0
do. 6½ Pref.	5	6½	5½	—	6 3 10
Castner-Kellner	25	20	3¹⁵/₁₆	— 1/16	6 8 1
Edison-Swan, "A"	—	—	15/16	—	8 0 0
do. do. 5 per cent. Deb.	4	5	74½	—	6 14 3
Electric Construction	10	10	1½	—	8 0 0
Gen. Elec. Pref.	6	6¼	10½	—	6 5 4
do. Ord.	10	10	17½	—	*5 12 4
Henley	25	25	2 1/16	—	5 8 1
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17	—	*5 17 8
Siemens Ord.	—	10	6¼	+ ½	*7 8 2
Telegraph Con.	20	20	24½	—	4 18 6

* Dividends paid free of Income Tax.

THE PRESENT ELECTRICAL OUTLOOK IN CANADA.

By A. S. L. BARNES, A.M.I.E.E.

(*Continued from page* 360.)

Canada has probably done more than any other part of the British Empire in developing water power, not only in actual horse-power, but in proportion to her available resources, and, in addition, very extensive surveys have been made, and an enormous mass of information in the shape of stream flow records, precipitation, run-off, &c., has been gathered; when a few more years have passed, such information will be sufficiently reliable, as furnishing details from which good average figures can be obtained, to enable engineers to gauge very closely the minimum power capacity of a large number of potential sources of hydraulic power. Records covering only short periods are practically useless for this purpose.

The water-powers of British Columbia have been roughly estimated at 3,000,000 H.P., of which some 230,000 H.P. have already been developed; the following are some of the uses to which this power has been applied:—

Smelting, mining, lighting and industrial power, tramways, lumber and wood-pulp manufacture, &c.

In the "Prairie Provinces" of Manitoba, Saskatchewan and Alberta, are to be found many great water-powers on the Winnipeg, Bow, Nelson, Saskatchewan, Churchill, Athabasca, Peace, and Mackenzie Rivers; those on the Nelson River alone, are estimated at over 2½ million H.P., this is said to be conservative; on this river there are 19 possible power sites that would produce from about 80,000 to 235,000 H.P. on the turbine shaft on a basis of a minimum flow of 50,000 cb. ft. per second.

For the Province of Ontario, the following tabulation gives the best and most recent authoritative figures:—

Total Amount of Power Capable of Development.	
Ottawa River and tributaries	688,000 H.P.
Great Lakes tributaries	446,000 "
Hudson Bay slope	250,000 "
James Bay slope	1,500,000 "
International boundary rivers	2,045,000 "
Total potentiality	4,929,000 "

Total Amount of Power Already Developed.	
Ottawa River and tributaries	71,000 H.P.
Great Lakes tributaries	137,000 "
Hudson Bay slope	22,000 "
James Bay slope	30,000 "
International boundary rivers	462,000 "
Total developed power	722,000 "

The estimated water power available in Quebec Province exceeds 5½ million H.P., of which only about 525,000 H.P. has been developed or approximately 10 per cent. of the total.

The Maritime Provinces of New Brunswick, Nova Scotia, and Prince Edward Island, have also very considerable water powers within their confines, although these are not found on the stupendous scale which characterises other portions of Canada.

Canada's share of the estimated low-water power on the St. Lawrence river alone is 1,800,000 H.P. of 24-hour power, and if diversity be considered, a demand of nearly 2½ million H.P. could be met from this source only. The power development on this river and its tributaries is already large—the Shawinigan Water and Power Co. has five power stations in operation, with a generating capacity of 350,000 H.P.; 11 of the generators are 20,000-H.P. units; six of the transformers are of 45,000 K.V.A. each; the transmission lines comprise 1,100 miles of high-tension lines, and include one span which is the highest and longest in the world—the span is 4,800 ft., and the height of the towers is 375 ft. above the St. Lawrence river; the maximum load on the systems was 220,000 H.P. in 1917, serving a population of 1,500,000 over an area of 20,000 sq. miles in 115 municipalities. The company states that the electro-chemical products manufactured in the Shawinigan Falls district annually have now reached a value of over £6,000,000; these products include calcium carbide, ferro-silicon, carborundum, aloxite, silicon, magnesium, carbon electrodes, steel, acetic acid, and its many derivatives, aluminium, &c.

The Montreal Light, Heat and Power Co. obtains most of its power from Cedar Rapids, where the Cedar Rapids Power Co. has a plant capacity of 120,000 H.P., and possesses water rights up to a capacity of 180,000 H.P. The first-named company handles altogether almost a quarter of a million H.P.; the net earnings have grown from £164,000 in 1902 to £1,120,000 in 1918.

Advertisements have recently been inserted in some of the daily papers, stating that in the vicinity of Montreal there is 300,000 H.P. of electrical energy available for sale to manufacturers; the advantages of the Montreal district were pointed out as well.

The Hydro-Electric Power Commission of Ontario expects to have 200,000 H.P. ready in 1921, and can, if necessary, increase this amount to 300,000 H.P.; and allowing time for the necessary works, a very few years would, if the demand warranted, suffice to enable it to increase this to 1,000,000 H.P., the whole being derived from Niagara Falls. It is expected that the cost of power in the Niagara district will fall below even the present favourable rates; that at Niagara Falls itself is about £2 5s. per H.P.-year.

During this year the Commission has had a peak load, on all its systems, aggregating over 200,000 H.P.; it commenced in 1910 with 750 H.P. Power is supplied at cost to 225 municipalities. About 5,000 hamlets and farm consumers are served, and during the war hundreds of applications from farmers had to be refused, as power had been requisitioned for the manufacture of munitions, about 75 per cent. of the total power supplied by the Commission being devoted to this purpose. The Commission's systems serve an area almost as large as that of England.

Canada possesses the largest electric-furnace installation devoted to steel manufacture in the world—this is located at Toronto, and comprises 10 6-ton Héroult furnaces, taking a normal full load of 1,500 KW. each; the output of each furnace averages probably about 35 tons per day, and, no doubt, it is possible to keep about eight of these furnaces in continuous operation, the other two being shut down for repairs, &c.

There are several other electric-furnace installations in the Dominion, one or two of them much larger than the one just mentioned, but the latter do not make steel.

As in England, during the war, many existing factories adopted electric driving instead of steam, gas, &c., and many new ones were equipped with electric motors.

Developments in electric traction have been held in abeyance, naturally, during the past four years, but this matter is bound to come to the fore again. Papers on the advantages of railway electrification like that of Mr. E. W. Rice, jun., before the American Institute of Electrical Engineers at the beginning of last year,* are sure to have an influence in Canada as well as in the States, and it is practically certain that if the Dominion Government takes over the Grand Trunk Railway, the question of electrifying considerable sections of this line, particularly in Ontario, will come up.

The use of electricity in houses is very much more common here than in England, and, in addition, people are more inclined to buy various appliances such as heaters, vacuum cleaners, smoothing irons (the smoothing iron load of the Hydro-Electric Power Commission on Tuesday afternoon is said to run into several hundreds of horse-power), toasters, coffee percolators, fans, electric-cooking stoves, &c.

Many farmers now have their premises lighted by electricity, and in Ontario they are making contracts for 2 H.P., this enables them to do the light work of the farm—milking, chopping, &c.—while the farmer's wife can

* Electrical Review, April 12th, 1918.

iron, sweep the carpets, &c. At times when more power is needed, *e.g.*, for threshing, silo filling, &c., several farmers pool their contracts and work as a syndicate; ten or twelve of them will combine thus and purchase a portable equipment comprising transformers, switches, &c., and a 25-H.P. motor; this is utilised by each farmer in turn, while all the rest undertake to use practically no current during the time when the large motor is in use, so that the sum of their respective 2-H.P. contracts is not exceeded. The rural lines which serve the farmers and hamlets are beginning to pick up other loads on the way—such as stone-crushing and brick-making plant, quarries, &c.

Electric pumping in municipal water works is also becoming very general, while, in the smaller towns, electric pumps with stand-by units consisting of centrifugal pumps direct-connected to high-speed gasoline engines in sizes up to 150 H.P. or so, are found to make a very good combination, as the more expensive steam stand-by, required for fire purposes by the Fire Underwriters, costs a great deal more to install, takes up much more space, and requires steam to be kept up in the boilers all the year round, thus running up a very considerable coal bill.

From the foregoing it will be realised that Canada's natural resources are wonderful indeed in their extent and variety, and that there will be immense developments during the next decade or so is hardly a matter for doubt, and in it all electricity will play a very important part.

Extension of existing hydro-electric systems, building of new ones, electrification of railways, more general adoption of electric power in mines, factories, and all kinds of industrial establishments, increased use of electric power for large electro-chemical and electro-metallurgical works requiring scores, or even hundreds of thousands, of horse-power, may be looked for, as well as a rapid growth in domestic demands.

Were Canada situated as are Britain's other "Dominions beyond the Seas," the electrical manufacturers might have a reasonably good chance of securing the greater part of the available trade in their lines without excessive effort; but this country is unlike all the other Dominions in having a great manufacturing, English-speaking nation at her borders—a nation that is fully alive to all the possibilities of this land, and does not intend to let any good chances slip through her fingers.

That the United States has faith in Canada and her economic soundness is abundantly evident from the way in which the inhabitants of that country have invested capital here, by establishing large industries. What numbers of American concerns now have their Canadian counterparts it is impossible to say, but there are certainly many of them.

Canadian statesmen, since the signing of the Armistice, have been speaking optimistically about the country's future; that is good policy, but now many of the business men are doing the same, and are speaking publicly in confident terms as to the prospects for trade. Responsible men connected with several shipbuilding firms in particular, have stated that there is work in sight for their plant for several years to come.

Canada expects, and is ready, to take a share in the reconstruction of the devastated portions of Europe—whether she can compete on an economic basis with the larger and older countries for such work remains to be seen, but undoubtedly most of the large firms are keeping a close watch on the situation.

(To be continued.)

X-Rays Applied to Concrete-Ship Construction.—The author of an article in the *Pacific Marine Review* has devised an application of X-rays as a means of maintaining a constant standard of moisture and disposition of reinforcement in concrete-ship construction. The procedure is to show by means of a series of X-ray photographs that the standard of uniformity of mix and compactness is maintained; to observe any misplacement of reinforcing, which, recognised in time, may still be remedied; and to detect the presence of voids as the structure develops, thus permitting of their timely elimination. The outfit weighs about 90 lb., and its cost is stated not to be excessive. The method will also be valuable for examination of vessels after sea experience.

FUEL ECONOMY FROM THE HOUSEHOLDER'S POINT OF VIEW.

By ED. C. DE SEGUNDO, A.M.Inst.C.E., M.I.Mech.E., M.I.E.E.

Last autumn there appeared in the Electrical Review an article entitled "The Householder and Clause 7 of the Coal Rationing Order," which appears to have been understood by a few and misunderstood by many, and suggestions subsequently reached me from various quarters to the effect that some *positive* statement upon the relative merits of gas, coal, and electricity, for warming our houses, would be welcomed by householders. This, however, is impossible of achievement, because few householders look at the matter from the same point of view, and the conditions to be fulfilled vary widely in different households. Moreover, human beings are not like Kew-certified thermometers which respond equally to identical thermal conditions, and the knowledge that x thermal units were being let loose in a room per hour would not induce the same state of consciousness in every individual mind. You cannot make a man feel warm by arithmetic however simple, and we do not *argue* with ourselves whether we *ought* or *ought not* to feel cold, we only know that we *do* or *do not* feel cold.

The efficiency, in practice, of any apparatus is a function of the degree of skill with which it is used. We all know that no special education is necessary to teach us freely to spend other people's money, and however economical a gas cooker, for instance, may be when operated by those who are interested in promoting the sale thereof, or who have to foot the bill for the gas consumed, the actual efficiency of that apparatus in the hands of the average domestic servant will never approach the attainable efficiency, and the discrepancy between the attainable and the actual may be quite alarming. The same remarks apply, of course, to the electric cooker.

There is one thing, however, to be said for the electric heater. When your meter registers one Board of Trade unit, you know that your electric stove has given out 3,410 thermal units (subject to a small variation one way or the other due to fluctuations in the volage of supply), and there are no products of combustion to be negotiated.

But when you have consumed 1 cb. ft. of gas—especially under present-day conditions of supply—you cannot be sure whether you have liberated 450 or 550 thermal units; indeed, while it cannot be *more* than the latter figure, it may be *less* than the former, owing to incomplete combustion, to variations in meteorological conditions, or to other causes, and there are products of combustion to be disposed of. But in the disposal thereof—according to modern practice—a certain ventilating effect is concomitantly produced, the value of which, in some form or other, should be credited to the performance of the modern gas-fire.

I will just set forth the results obtained by certain modifications I introduced in my heating arrangements at home at the end of September, 1918, in consonance with the admonitions of the Coal Controller. (This does not imply agreement with *all* his conclusions.) While these results are of no scientific value, they serve at least to emphasise the influence of some of the "indeterminate factors" referred to above.

I suppressed :—

A large gas cooker in the kitchen (rated consumption unknown).
Two gas fires (rated at 44 and 50 cb. ft. per hour).
One gas radiator (rated at 50 cb. ft. per hour).
One gas stove (rated at 40 cb. ft. per hour), and
Four incandescent gas burners (presumably 5-ft. burners).

I retained :—

Four gas stoves (rated at 35 cb. ft. each per hour), and
Three gas burners (one very seldom used).

I installed :—

Three 20-in. high and one 25-in. high Magnet stoves, burning anthracite and coke (incidentally, these very useful stoves will consume many other forms of "combustible").
One 6-ampere hot plate (used very seldom).
Two two-bar and one three-bar Arora electric heaters (rated at 750 watts per bar).
One 50-watt half-watt lamp.
Two 20-watt lamps.

My house is lighted throughout by electricity.

The cost of installing and connecting up the separate heating circuit and mains, and of apparatus purchased, was, roughly, £30.

The comparative consumption of gas, coal, and electrical energy, is given in the following table:—

—	Last quarter of 1917.	Last quarter of 1918.	1917-18.	1918-19 estimated.
Coal	7 tons	4·50 tons	15 tons	18 tons (including anthracite and coke)
Anthracite ..	—	0·75 ,,	—	
Coke	—	0·30 ,,	—	
Electricity—Heating ..	—	261 units	—	800 units
Gas—Lighting } ..	51,200 c.f.	7,250 c.f.	193,000 c.f.	23,000 c.f.
Heating }	Proportion for heating estimated at 40,000 c.f.	Proportion for heating estimated at 5,100 c.f.		

So far as the gas cooker in the kitchen is concerned, I am in a position to convict it out of the gas company's own mouth—or, rather, meter readings. From September 11th to October 1st (on which date the cooker was disconnected), the consumption was, on the average, 130 cb. ft. per day. Probably the manufacturers could make it do the most astonishing things for 130 cb. ft. of gas a day. Be that as it may, by the abolition of this cooker, the gas radiator, two gas fires, one gas stove, and four gas burners, I have reduced last quarter's gas consumption by 85 per cent., as compared with the corresponding period in 1917, and have not increased my coal consumption, and everyone in my house considers that the heating is more satisfactory than it was under the old plan.

It must be clearly understood that I am not condemning the gas cooker, nor the use of gas for heating or cooking, *in principle*. I am simply recording the results of observations which show clearly the great discrepancy in practice between "attainable" and "actual" performance, but in what proportions this is to be divided between avoidable and unavoidable waste, it is not easy to say. The "coefficient of moral responsibility" is not the same in all domestic servants—or other individuals. I must, however, assume the "coefficient of rectitude" of my gas meter to be a reasonably constant quantity. I have tested for leakage, and find it negligible, about 250 to 300 cb. ft. per annum.

Now, as to the financial result. For the purposes of comparison, we must, of course, adopt the same prices for the fuels, respectively, in 1917 and 1918. Let us put gas at 4s. per 1,000 cb. ft.; and coal, anthracite, and coke, at 35s. per ton.

The comparative cost for heating would then work out as follows:—

—	Last quarter of 1917.		Last quarter of 1918.	
Coal	7 tons	£12 5 0	4·50 tons ...	£7 18 0
Anthracite ...	—	—	0·75 ton ...	1 6 0
Coke	—	—	0·30 ton ...	0 12 0
Electricity ...	—	—	261 units ...	1 6 0
Gas	40,000 cb. ft.	8 0 0	5,100 c.f. ...	1 0 0
		£20 5 0		£12 2 0

This shows an appreciable saving, and there is no doubt that, so far as feeling "pleasantly warm" is concerned, we have been much better off under the new *régime* than under the old. But it by no means necessarily follows that a similar "household" living in a similar house would have had the same experience. Very much depends, for instance, upon the number of rooms in which *continuous* heating is desirable or necessary. Supposing, for instance, that some of us had fallen victims to the "flu" during the last quarter, my consumption of fuel for heating would unquestionably have been much greater. I cannot be absolutely sure that, so far as *necessity* is concerned, my heating *requirements* were exactly similar last quarter to those in the corresponding quarter of 1917.

My "Arora" electric heaters have been most useful for heating rooms occupied for short periods. In such circumstances they certainly possess advantages over the gas stove, as they are portable and their "range of action" can be made as wide as one pleases by a little forethought in selecting suitable positions for the wall plugs. No doubt a gas stove would have been cheaper per 1,000 TH.U. usefully emitted, but, as I was situated, *I* would rather pay more, and have my "Aroras." That, however, is a purely personal matter.

There is not the slightest doubt that everyone of us could effect considerable economy, without sacrificing comfort, by care and attention to detail, however our houses may be heated; but I would not like to go so far as Mr. A. H. Barker, who, I believe, claims that the 30,000,000 tons annually used for domestic heating could be reduced to 6,000,000 tons.

There are many staunch advocates both of electricity and gas for cooking. Considered purely as a means of generating heat for cooking food, I think there can be little question as to the superiority of electricity over gas. The question of cost is one which everyone must decide for himself. The cash paid for the fuel consumed is by no means the only factor, nor, perhaps, the most important factor, when cleanliness and health and dietetic considerations are in question. Furthermore—as has been remarked above—so far as heat content is concerned you know where you are with a Board of Trade unit; you cannot always be so sure with a cubic foot of gas. A Board of Trade unit is equivalent to 3,410 B.TH.U. At 500 B.TH.U. per cb. ft., 6·82 cb. ft. of gas should liberate the same quantity of heat. Thus electricity should cost 0·2d. per Board of Trade unit in order to be on a par, as regards cash value, with 500 TH.U. gas at 2s. 6d. per thousand.

But it is difficult to see how a gas cooker—with any pretence of avoiding the risk of contamination of the food by the products of combustion—can transmit to the food as high a proportion of the heat liberated as the properly designed electric cooker. I do not think my gas friends should quarrel with me if I put the relation of the two as x for the electric cooker to 0·7 x for the gas cooker. In other words, instead of 6·82 cb. ft. of gas, you would have to burn $6{\cdot}82 \times 1/0{\cdot}7$, or 9·74 cb. ft. of gas to obtain, *in effect*, 3,410 useful thermal units.

Again, there are other fuels. Anthracite, for instance, which is *not* suitable for gas making. Mr. Dowson and others have shown that 1 B.H.P.-hour can be generated with a consumption not exceeding 1 lb. of Welsh anthracite. This might easily correspond to not exceeding 1½ lb. of fuel per KW.-hour supplied if a man had his own poor-gas plant. If, moreover, the generation of electrical energy for heating were dovetailed in with the other calls on his power plant, the cost of generating the additional electrical energy for heating need not very greatly exceed the cost of the additional fuel consumed.

Putting anthracite at 30s. per ton, such extra cost, all told, might easily approach 0·25d., as against 0·2d. for gas (at 2s. 6d. per 1,000) for equivalent heat value.

In such circumstances, a man who set any store by cleanliness and other hygienic factors, would not hesitate to employ electricity for all heating purposes. If the practical efficiency of the electrical and the gas-heating devices be taken as 100 to 70, the cost would be 0·25d. for electricity as against 0·28d. for gas, and electricity would thus be practically on a par with gas as regards cost.

No very useful purpose can be served by the mere tabulation of *ex parte* statements on the relative merits of gas and electricity. It is a subject for discussion—not for controversy, because, as a very eminent man has told us, "by controversy a man is rarely persuaded of anything except of the truth of his own view." Each has its merits, and can only usefully be considered from that point of view. Many important factors enter into this question (ventilation, for instance), a complete consideration of which could only be attempted in a treatise.

If householders were to install a separate apparatus for their hot-water supply, and seek competent advice upon the system of heating best suited to this and their other requirements, we should have travelled a long way on the road to Mr. A. H. Barker's ideal saving of 24,000,000 tons coal out of the 30,000,000 tons annually consumed for domestic purposes.

SOME NOTES ON ELECTRICAL METHODS OF MEASURING BODY TEMPERATURES.

By ROBERT S. WHIPPLE, M.I.E.E.

(Abstract of paper read before a joint meeting of the Royal Society of Medicine *and the* Institution of Electrical Engineers.)

The study of body temperatures is of importance, especially in connection with the preliminary stage of phthisis. The object is to study in an elaborate manner the normal curve of the temperature of man, and the changes which that curve exhibits during the very earliest stages of pulmonary consumption and of surgical tuberculosis, when the organism is the prey of the tubercle bacillus alone and not yet subject to a "mixed infection"; for Gamgee realised by long-continued observations carried out with the clinical thermometer, the utter want of precision and insight which prevailed in reference to the very earliest stages of phthisis, when physical signs are yet almost, or completely, in abeyance, and when the cough, the anæmia, the loss of flesh, and slight temperature abnormalities are the only guides the physician has to rely upon.

Gamgee decided to adopt thermo-electric couples in preference to resistance thermometers, and for work of high precision his decision was a correct one.

The thermometers used were of two kinds, one for taking

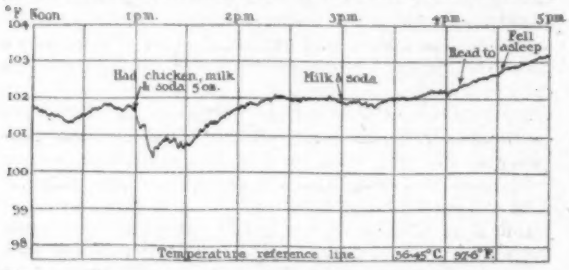


Fig. 1.—Temperature Record obtained with Photographic Recorder.

the temperature of the surface of the skin and the second for taking the temperature of the cavities of the body. The thermo-electric couples were made of copper-constantan.

Gamgee placed his cold junction in a water bath heated by a gas burner controlled by a sensitive Lowry toluol regulator, the temperature of the bath remaining constant to within 0.01 deg. C. during periods of 10 to 15 days. By placing the cold junction in a vacuum flask immersed in the water bath so much lag between it and the water is introduced that the temperature remains constant over long periods of time to within 0.01 deg. C.

To heat the water bath electrically, a modified form of toluol regulator fitter with platinum contacts, so that the mercury opens or closes an electric circuit, may be employed. This circuit brings into operation a sensitive relay, which in turn makes or breaks the current in the heating circuit.

A great many types of thermo-couples for determining the skin temperatures have been devised, the simplest model of all proving to be the most satisfactory. It consists of a copper-constantan couple, the wires of which are 0.1 mm. (0.004 in.) in diameter, mounted between two pieces of canvas embedded in rubber and vulcanised, the couple being exposed on the surface of the rubber.

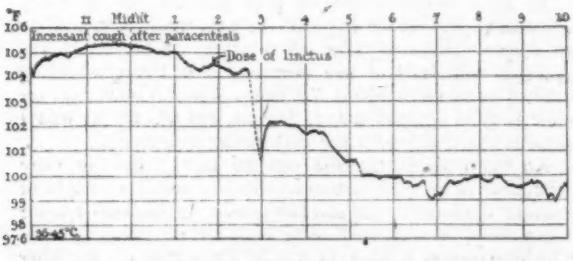


Fig. 2.—Record obtained with Thermo-couple and Thread Recorder.

In a thermometer of this type the lag is less than a couple of minutes, and the instrument is admirably adapted for taking surface temperatures. The rectal thermometer as used by Woodhead and Varrier-Jones consists of a No. 6 rubber catheter, the couple or junction being embedded in the eye of the catheter, and the surrounding space filled with rubber solution which has been allowed to dry. The junction is brought flush with the surface of the rubber tube, and is fully exposed. This thermometer also has a lag of about two minutes. The recording apparatus consists of a moving-coil galvanometer of the D'Arsonval type, the movements of which are recorded either photographically or autographically by an inking device.

The photographic recorder developed by Gamgee was a very efficient instrument. The galvanometer was of the sensitive moving-coil type, 10.5 ohms in resistance, and gave a deflection of 12 mm. per micro-volt on the photographic paper, which was 116 cm. from the galvanometer. The electromotive force given for a copper-constantan couple is about 40 micro-volts for a temperature difference of 1 deg. C. It was necessary therefore to place manganin resistances in series with the galvanometer coil to reduce the sensitivity of the galvanometer, and also to reduce the temperature coefficient of the circuit.

The manganin resistance was made adjustable so that varying degrees of sensitivity could be obtained. A sensitivity of about 40 mm. per deg. C. was frequently employed, although for special cases 120 mm. per deg. C. could be used. The bromide photographic paper (200 mm. wide) was moved by clockwork at a rate of 1 mm. per minute. By means of a shutter a beam of light from a fixed mirror was occulted every half-hour, so that a time scale was marked on every record sheet. This record also formed the zero reference line, the distance of any point on the temperature curve from it being a measure of the temperature at that point. The optical arrangements of this instrument were particularly simple and efficient. The image of a slit in front of a Nernst lamp fell on a very narrow horizontal slit placed close to, and in front of, the photographic paper. A reproduction (half full size) of a small piece of a record is given in fig. 1, which shows well the sensitivity of the apparatus.

In accurate research work no autographic recorder can compare with a photographic one. The thread recorder is a variety of the continuous recording moving-coil galvanometer.

Fig. 2 is a reproduction of a record obtained by Gamgee in a case of pneumonia, almost certainly of tubercular origin,

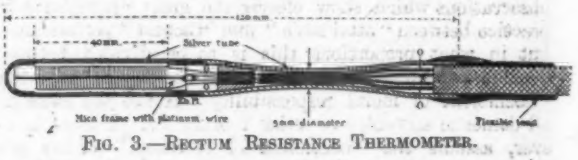


Fig. 3.—Rectum Resistance Thermometer.

taken with the thread recorder. At 10 p.m., paracentesis on the left pleural cavity was performed to withdraw the greater part of a large effusion which had formed. The operation was followed by a rise in temperature from 104.2 deg. F. to about 105.3 deg. F., probably in great measure accounted for by the incessant coughing of the patient. At 1.25 a.m. a dose of the hospital "linctus," containing 12 drops of liq. morph. hydroch., was administered. The cough was almost at once relieved, and at 3.25 a.m. the patient fell asleep, when the temperature sank almost suddenly, as shown by the curve, to 100.5 deg. F. This curve, which represents temperature changes, illustrates admirably the value of the method of registration under discussion.

The thermo-electric method is unsuitable for general use on account of the delicacy of the apparatus and the necessity of employing an elaborate thermostat. With the resistance method no thermostat is required, and it is easy to obtain a tenfold deflection with the same galvanometer. When a rectal thermometer is used, the resistance coil—assuming it is correctly designed and made—follows the temperature changes in the body without appreciable lag.

For clinical work the resistance thermometer offers the great advantage that the apparatus is robust and simple. A thermometer, the particular design of which is due to Dr. Varrier-Jones, is shown in section in fig. 3. The essential part is a fine platinum wire wound round a mica frame in the form of a cross, the coil on its frame being enclosed in a silver tube. This tube is constricted so that it may not irritate. The thermometer coil is connected by comparatively heavy copper leads to the instrument by which the temperature is to be recorded. The electrical details of the arrangement are shown diagrammatically in fig. 4. The arrangement consists of a Wheatstone bridge in which the thermometer forms one arm, balancing coils being arranged in the opposite arm to balance the resistance of the thermometer at any predetermined temperature. Ratio coils of equal resistance and of approximately the same resistance as the thermometer are inserted in the other arms of the bridge. In addition to the leads attached to the thermometer coil two other leads, or compensating leads, are carried from the thermometer to the recorder. These leads are short-circuited near the bulb of the thermometer, and are introduced into the opposite arm of the bridge to compensate for the effect of changes in temperature of the leads.

The moving-coil galvanometer is connected across the arms of the bridge, and it is the deflections of the coil that are recorded. For the small angle through which the coil is deflected (maximum 25 deg.) the deflections are proportional to the amount the bridge is out of balance, viz., to the change in resistance of the thermometer coil with a given change in temperature. In a direct deflection method such as this, the galvanometer deflection must depend on the electromotive force of the battery, and what few complications there are in the apparatus have had to be introduced to control this. The method of adjusting the apparatus is simple.

Before the battery circuit is closed the zero of the galvanometer is determined. This should be on the line corresponding to the lowest temperature (say 96 deg. F.) recorded by the thermometer. If it is not, the pointer is readily brought into the desired position by rotating the torsion head from which the galvanometer coil is suspended.

The electrical zero of the bridge—the one in which no current is passing through the galvanometer coil when the battery switch is closed—is then determined. The plugs attached to the heavy flexible leads, and shown symmetrically on both sides of the diagram, are placed in the zero positions. The thermometer coil and its leads, and the corresponding balancing coils and compensating leads, are then cut out, the ratio coil being balanced against the coils R_1 and R_2. If when the switch is closed the galvanometer is not deflected, the electrical zero is correctly adjusted. If it is deflected, the slider S is moved on a slide wire until balance is restored. The instrument must then be adjusted so that the galvanometer coil is deflected through a definite angle for a given change in the resistance of the thermometer. Experience showed that the making of the test by heating or cooling the thermometer was tedious, and as the test should be made

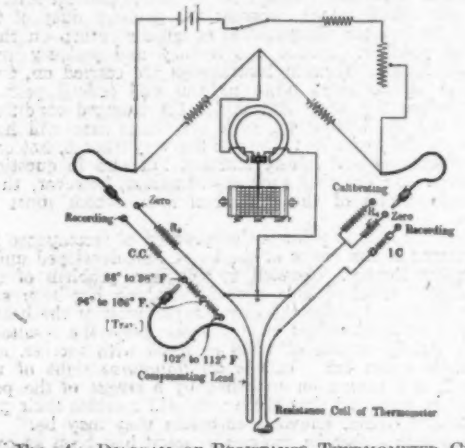


Fig. 4.—Diagram of Resistance Thermometer Circuit.

every 24 hours it was advisable to introduce a test resistance which would be equivalent to an increase in the resistance of the thermometer for a given change in temperature. In practice a manganin coil having a resistance equal to the increase in resistance of the thermometer coil for a rise in temperature of 10 deg. F. is used. This is marked "calibrating," and is shown on the right of the diagram. When this is introduced the galvanometer should be deflected, and the pointer should read 106 deg. F. If it reads low then the electromotive force on the bridge is not sufficiently high, and should be raised by cutting out some of the battery resistance by means of the rheostat. In the same way, if the galvanometer reading is too high the electromotive force should be reduced. In the later form of the instrument the sensibility is altered by an adjustable magnetic shunt, thus avoiding the use of a rheostat.

These various adjustments having been made, the two plugs are placed in the "recording" positions, and the apparatus is ready for use. The travelling plug (Trav.) is placed in the hole corresponding to the temperature range desired, the usual one being 96 deg. F. to 106 deg. F. By introducing or cutting out the coils shown in the arm of the bridge opposite to the thermometer, the range over which records can be obtained may be varied.

The thermometer should be slightly warmed, and will record the temperature of the body in about 5 minutes after insertion. A record obtained by Dr. Varrier-Jones with a thread recorder and resistance thermometer is reproduced half size in fig. 5.

In practice the outfit is simple to operate; the recorder and its accessories are so simple that to the medical man accustomed to using some of the modern medical-electrical apparatus the instrument can be regarded as another tool added to clinical medicine.

Summarising the experiments of the chief workers in the subject from the instrumental point of view, it may be said that:—A continuous record of the temperature of the human body can be best obtained by an electrical thermometer placed in the rectum. For accurate research work, when it is desired to record variations in temperature to an accuracy of 0.02 deg. C., a thermo-electric couple must be used in conjunction with a photographic recorder. If rapid or very small variations in temperature are being recorded a photographic recorder must be used. For ordinary clinical work a resistance thermometer with an autographic recorder is the most practical instrument. It can be relied upon to record body temperatures to an accuracy of at least 0.1 deg. C.

Prof. G. Sims Woodhead, in opening the discussion, exhibited numerous records showing the variations in temperature that occurred before and after the administration of tuberculin. Records of both human and animal subjects were shown, the speaker explaining how the variations of temperature so recorded aided the physician in his diagnosis. In his opinion, the method would be of very great value in all cases of fever. One advantage of the method was that the recording apparatus could be located in the laboratory while every bed in the hospital could be wired up to it, so that it was not necessary to transport the whole apparatus from bed to bed as each record was taken.

Dr. P. C. Varrier-Jones explained that resistance thermometers were preferable when measuring the body temperatures of animals, and thermo-couples in the case of human

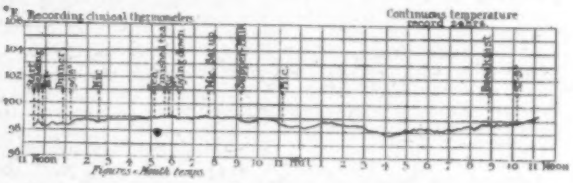


Fig. 5.—Record obtained with Resistance Thermometer and Thread Recorder.

subjects. Two great advantages were that the apparatus was extremely simple, and records could be taken over long periods without the slightest objection on the part of the patient. It was also possible to obtain what might be called an inverted curve of the patient's temperature, and thereby a very early diagnosis was possible.

Dr. E. P. Cumberbatch said that, in connection with recent experiments on diathermy, he had attempted to ascertain the temperature rise of an internal organ of a patient by means of a thermometer inserted close to the organ. An electric current was passed through the patient's body by means of external electrodes, but apparently the current passed entirely through the periphery, because after an interval of 20 minutes the thermometer indicated no change of temperature whatever. He suggested that if it could be possible to determine the temperature rise, if any, in such a case by the method described in the paper it would be of the greatest utility and importance.

Mr. E. H. Rayner expressed admiration for the work done and apparatus used as described in the paper. When the very small differences of temperature that were measured and the extremely low voltages and currents that were used were considered the results achieved were, in his opinion, marvellous. The degree of accuracy attained was very high, and it reflected much credit on the Cambridge Scientific Instrument Co., Ltd., for having developed the apparatus with which such results could be obtained.

CO-ORDINATION OF RESEARCH IN WORKS AND LABORATORIES.

By the late H. R. CONSTANTINE, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

There was a time when this country was able to hold its own against any other nation in all branches of science, but the opening years of the present century found us rapidly falling asleep and allowing our present enemies to take our place.

The reasons for this are not to be found in any lack of ability or want of inventive genius; nor to any incapability to carry out the work prescribed by the brains of the nation. The material has been there all the time, and our backsliding has been entirely due to lack of responsiveness to scientific genius by our responsible Government authorities, manufacturers, and financial leaders, as well as to the absence of organisation. Many examples could be given of new ideas or inventions devised by British brains which have met with absolutely no reception, and have therefore been taken abroad, there to be eagerly picked up.

After having lived on the Continent for over five years, and after mixing with scores of Germans of all classes, and especially engineers, the author would emphatically state that their average intelligence is no greater than that of a batch of similarly-situated Englishmen. As a result of improved methods of education, with special reference to science and engineering, the knowledge may be greater or wider,

but the actual intelligence or genius is certainly not superior. The only real advantage which the German firms have had in the past over British competitors lay entirely in the capacity for organisation and the recognition of the possibilities of raw ideas.

This capacity for organisation is not entirely inborn, but is mainly the result of intensive training and development during the past two generations. If we had gone to the same trouble, we could have become at least as proficient in the art. This has been proved time and again during the present war.

German organising capacity was devoted to the good of the German nation as a whole. This is a most important point, and may be considered as the crux of the whole question. The German people, whether willingly or as the outcome of its educational system, or compelled by force akin to militarism, has been taught to sink self for the common good, to sacrifice individualism for collectivism, for the purpose of conquering the world's markets for the benefit of the nation as a whole. The Britisher, on the other hand, has as an individual been so proud of his own prowess as to want to fight all his own battles, being too stubborn or selfish to communicate his methods of working to his fellow-workers. To be independent is in many respects a praiseworthy constituent of a man's character, but if we don't adapt ourselves to changed conditions, we deserve to get left behind in the race.

Apart from the co-operative efforts arising out of or in connection with the war, the past two years have seen the birth of many combinations of interests for the sole purpose of strengthening and extending the trade of the country after the war. We now have several powerful banking amalgamations to offer a stronger financial front against external competition, numerous unions of workmen to protect the rights of the individual worker, and various associations of employers to further their different businesses. Among the latter are to be found financial combines to assist the weaker members in times of monetary stress, manufacturing associations to prevent too keen a competition and too much overlapping between the different works, to say nothing of the co-operative selling organisations to simplify and cheapen the getting of orders, especially abroad. In every case the fundamental principle underlying the co-ordination is to be found in the words "unity is strength."

But amongst all these co-operative organisations we must look in vain for the slightest approach to any real co-ordination as far as research into new and improved principles or better methods of manufacture is concerned. It is true that quite recently the Privy Council appointed a Committee for Scientific and Industrial Research, which received a grant of £1,000,000, took over the National Physical Laboratory, and is at present carrying out researches on the production of tin and tungsten in Cornwall; also that a National Fuel Station has been established at Greenwich, that a British Scientific Instrument Research Association has been formed, and that several other minor attempts at co-ordinated research have been made, but nevertheless each individual manufacturer is still content, generally speaking, to jog along on his own, too independent or too proud to seek the help of his fellow-workers.

For the above reasons the whole proposal to erect a new national research laboratory and to employ whole-time inventors may be abandoned as being impracticable. As an alternative scheme, use could be made of the existing laboratories of the country, universities, colleges, technical institutions, and most manufacturing concerns. Although perhaps we have still a great deal to learn from foreign countries as regards adequate facilities for research, yet we undoubtedly possess many absolutely first-rate research laboratories where much excellent work has been and is being done. This is the basis of the scheme which is now propounded, as such a scheme appears to offer the only practicable solution of the problem.

Briefly outlined, the scheme consists in centralising under one board or committee the control of all the research laboratories attached to the universities, colleges, and training institutions of the country, as well as of a large number of similar experimental laboratories connected with private works. Such a board would keep full records of what each individual laboratory was doing, and would receive all inquiries for research work to be done, whether the same came from inside or outside the laboratories in question. Furthermore, the board would keep all published research records of the world, and would thus be able to guide individual laboratories in their work. The board would be invested with full powers to order any laboratory to undertake certain research work or to leave another research alone, or indeed to transfer, if considered advisable, part of its equipment and personnel to another laboratory. Finally, all new discoveries would be communicated to the board, which would at its discretion publish the same openly, or else give them or sell them as trade secrets to interested British manufacturers or combines.

From what has been said, it might appear as though the board were to take absolute control of the university laboratories. This is not so; the powers exercised by the board would be similar to those of the existing Board of Education, only controlling the work done, specifying certain methods of working and stating definite results which have to be achieved, without any actual interference in the ownership or management. University laboratories would still be used for training purposes as they are at present, and the ordinary degree or diploma courses would not have to be altered in the slightest. Not routine training work, but only absolutely new experimental work alone would be affected. The Board would work hand in hand with the various boards of management of the universities, and would merely order that specified research work had to be undertaken with certain equipment during a certain time, giving general instructions as to the carrying out of the research and also supplying all available information on the subject from the central library. The actual details of the experiments, as well as the selection of the personnel to carry out the tests, would as a rule be left to the university authorities.

In the above-outlined control of the board over the university laboratories it has been assumed that the exact powers exercisable would be defined by Act of Parliament. The scheme would probably work quite smoothly on a voluntary basis without any special legal powers, provided each party worked in a spirit of give and take, realising the while that the co-ordination was not only to their mutual advantage but also for the benefit of the nation.

If the scheme is to be truly national in character the laboratories run by manufacturing concerns must also be included. There are in this country a great number of well-equipped works laboratories, even if the majority are not up to the standard of those found in Germany or America. These laboratories must certainly participate in the scheme of co-ordinated research, because there is perhaps more overlapping and groping in the dark here than in the case of university laboratories. That this is so, and is indeed practically unavoidable under present conditions of working, is clear from the very nature of such laboratories.

Such laboratories cannot, owing to the nature of their constitution, be dealt with in exactly the same way as university laboratories. The latter work entirely in the general interest of scientific advancement, whereas the primary duty of the former is to give the shareholders as large a return on their money as possible. Hence the secrecy and jealousy with which the investigations in laboratories are carried on, such a state of affairs being quite natural and indeed perhaps healthy before the war. But under the changed conditions which will prevail later on, each individual firm will have to stand by and assist its fellows to the very utmost, not only in manufacturing and selling matters, but also in questions of research. In devising such co-ordination, however, there are certain rights of the individual firms which must be preserved.

One very important point is the question of recompense for ideas brought to the notice of the board and developed under the auspices thereof. Coupled to this is a problem of the patent rights attached to a new idea which has been successfully developed under the direct supervision of the board. At present each individual experimenter keeps the results of his work strictly to himself until crowned with success, and a patent is taken out. This is an important right of the individual, and cannot be abolished by a stroke of the pen. It cannot be expected that these men will sacrifice their present financial rights, however uncertain they may be.

Suppose that a chemist under the board had been successful in discovering a practical commercial formula for the manufacture of synthetic rubber. The board would, in the first place, satisfy itself through its experts that the invention was absolutely genuine and fulfilled all that was claimed for it. The rough details of the composition would then be communicated to all firms connected with the board who were likely to be in a position to take up the manufacture, and approximate estimates of the cost of production would be called for. The next step would be to pass on details of what was claimed for the material, along with the cost estimates, to all firms under the board who were likely to be able to make use of the same, and at the same time approximate figures of the quantities which could be taken per year would be asked for. Once in possession of the latter, the board would be able to decide as to the net commercial value of the invention to the nation, and would proceed to reward those who had worked to produce the result, this applying not only to patentable ideas, but also to mere suggestions for improvements.

Another reason for the introduction of protection by patents is to be found in connection with foreign competitors. Hence full use would have to be made of the existing international patent laws. It would be of no use setting up a co-ordinated scheme of research in this country if the fruits thereof could afterwards be exploited by manufacturers abroad without let or hindrance. This whole question of patents would be enormously simplified by the bringing of our own patent laws more into line with those of America and by the introduction of an Empire patent.

Regarding the disposal of the foreign rights of a patent, the board, as ultimate owner of the parent patent in this country, would have to decide whether it was advisable to allow foreign firms to take up licences in order to compete with the home manufacturers. A comprehensive national scheme such as the one under consideration cannot be carried through successfully without adequate financial support. The financial side of the question must not be made paramount to its national importance. As far as possible it is proposed to make the scheme self-supporting, with perhaps the exception of a State grant at the commencement; but

even if it be found impossible for the board to pay its way this fact should not lead to the rejection of the scheme. The whole idea should be looked upon as an absolutely necessary national bulwark erected to protect and assist British manufacturers. The board should be treated in a similar way to the Boards of Trade and Education, being made as self-supporting as possible, but any unavoidable deficit being covered by a Parliamentary grant.

It is not pretended that the scheme outlined is complete in all details or that the plan proposed is the only suitable one. The chief object was to show that some form of co-ordination in research is necessary, not only from the national point of view, but also in the interests of the individual manufacturers and experimenters. The scheme outlined has been gone into fairly closely in order to show that the practical solution of the problem is by no means as difficult as might be supposed on the first consideration. Finally, the author suggests that the Institution take the initiative and invite a conference of all interested parties, to settle the absolute necessity for some such concerted action, and to come to some decision as to the general outlines which such a scheme should have. This conference could then appoint a smaller committee to work out the details, which would be submitted for approval before the plan was definitely put into operation.

Discussion in London.

Dr. W. Rosenhain, opening the discussion, said it was evident that the paper had been well and fully thought out. He, however, disagreed both fundamentally and otherwise with practically all it set forth, with the exception of what had been said in reference to co-operation. That was very necessary, not only with respect to the leeway that would have to be made up, but also respecting the application to industry of the results achieved. He took exception to the board of directors as suggested; in his opinion, such a board would very probably sterilise the whole business. In research work such a board could not possibly decide when the truth had been found. Again, it could not possibly see beforehand which particular laboratory or man was the right one to carry out a particular piece of work. That would have to be left to the initiative of the individual. Much had been said about overlapping, but in his opinion that was not such a serious thing in research as it might be in other work; indeed, in certain circumstances, it might even be healthy in research. Under any such scheme as the one outlined in the paper an important point would be the selection of the right type of man to carry out the work; but he did not think the particular scheme outlined by the author would attract the right type of man. With regard to the author's support of university laboratories in the interests of economy, he pointed out that a large central laboratory was already in existence, namely, the National Physical Laboratory. What was, in his opinion, of more immediate importance was the establishment of a central clearing house for information. In the course of his work he received numerous inquiries relating to all manner of things, and of course he was only too glad to answer any such when it was in his power to do so, but unfortunately that was not always the case, not to mention the amount of time and labour that was involved. Now it ought to be someone's particular business to supply such information on request, and a bureau where one could apply for information, no matter in what part of the world such information originated, would be of immense value.

Mr. Leon Gaster, speaking of the young man of the future and his rights, cited the case of the man who took a new idea or invention to his employers, but was turned down, told there was nothing in his idea, and probably got dismissed. Then his employers proceeded to develop the idea as their own, and reap the benefits. As long as such a state of affairs prevailed there was no incentive to invent, and he submitted that every man should have the option, if his employer turned down a new idea in the first place, to carry the thing out himself, and personally reap the benefits. He agreed that a central bureau of research information was very necessary and muchly needed. So many papers were being read that they did not really know where they were; the position was bewildering, and to search out the essential facts involved much labour and waste of time. The paper seemed to suggest that the universities would be ordered, so to speak, to do certain things or carry out specified work; such a scheme, in his opinion, would not be practicable.

Col. H. W. Couzens, who had been in charge of the wireless research department of the Army, said that Germany always maintained that this country would go under, and could not help doing so, because no attention was paid to scientific research. War had been raging between Germany and this country not merely for four years, but for the past 32 years, and it would continue. He maintained that it was much more important to inform one's partner than to deceive one's adversary, and that had been the policy throughout the war. Co-operation was necessary, not only radially, between headquarters and branches, but also circumferentially between branches. He was not altogether in favour of control, what they really wanted was information and not a central authority; that, in his opinion, was the crux of the present difficulty. Many ideas had been and were lost for the want of funds or special facilities for further development. He suggested that university scholarships should be rather in the nature of special facilities for continued work than in the form of prizes. After all, it would be the man who created who would control.

Mr. H. Pearce thought that the ideal to be aimed at was decentralisation of control. The author suggested the expenditure of large sums annually on his scheme, and he (the speaker) wondered what proportion of those sums would be devoted to actual research work. The problem of spreading information was of much importance; he suggested that the record office of every technical institution or association should be in touch with one central bureau where anyone might apply for information.

Mr. C. C. Paterson, O.B.E., agreed with most of the opinions expressed by speakers, and consequently disagreed with the author in nearly every particular. He did not believe any large scheme was necessary, they had no actual information to show that it was. He did not see why it was proposed to divorce one section of work from another; research work was a continuous process, one thing leading up to another. Again, it was a mistake to try and eliminate overlapping in research work. A certain amount of overlapping was vital if the best results were to be arrived at. It was an extremely low view to take that industry was carried on solely for the making of money; he would not believe otherwise than that industry worked in the interests of the country as a whole, and of mankind generally. That was as it should be, and the same remarks applied to research work.

Mr. E. T. Williams took a contrary opinion to the majority of speakers; he thought the scheme outlined in the paper, if not perhaps in detail, was most valuable in spirit, and it contained a number of good instances. The Germans, if in nothing else, really excelled in organisation and in getting a large view of things. This was also now the case with the Americans, who possessed the added advantage of the creative faculty, and he maintained that those nations who used their brains were the ones that would lead. By means of a diagram he showed that some simple means of co-ordination rather than a vast organisation was desirable to start with.

Mr. J. S. Highfield, in reply, said that the discussion, though highly critical, plainly showed that the paper had served its purpose. He was in entire sympathy with those who had spoken in favour of decentralising control. He had lately come to absolutely loathe the words "organise" and "co-ordinate," they sounded so very important and impressive, but in reality they meant very little indeed. With regard to overlapping, rather than being a disadvantage he thought that it was extraordinarily useful. The sporting element and spirit of rivalry had always been and still was a desirable attribute of the Englishman, and that should be remembered when discussing so-called overlapping which was really competition. At the same time, firms would have to work together more in the future; a start in this direction, which was the right one, had already been made.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Low Oscillographic Manograph.

Internal combustion is a difficult and somewhat mysterious problem. What it is really required to know is what happens to the petrol and air whilst the mixture is in the cylinder. A new apparatus—the Low oscillographic manograph, which is exhaustively dealt with in the March 4th issue of *The Motor*—enables the actual conditions inside the cylinder of an internal combustion engine to be examined while the car is running on the road, and the results can be observed on the car during a road test, or in the laboratory with the car any distance away. When an engine is running at 2,000 to 4,000 r.p.m., mechanical and gaseous phenomena cannot be observed in an ordinary manner, and to get instantaneous changes of pressure, even with the best indicators, is difficult when working close to the engine. Major A. M. Low,

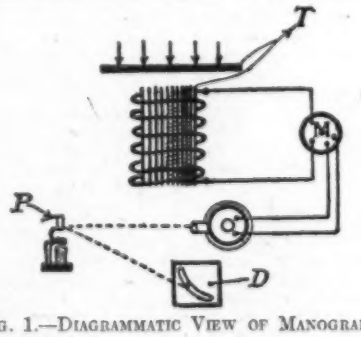


Fig. 1.—Diagrammatic View of Manograph.

R.A.F., D.Sc., has found that it is of more practical value to examine valve motion by means of a synchronous bioscope, and to connect the pressure indicator direct to the engine, utilising some simple means for roughly marking portions of the stroke which can be afterwards calculated exactly. To do this he has utilised an oscillographic manograph, with which he has investigated valve-bouncing engine indicator work, then spectroscopically testing the mixture *via* the kinematograph at any predetermined portion of the stroke. The essential features of the oscillographic manograph are shown diagrammatically in fig. 1. M is a microphone of special type; T is a kind of telephone receiver with a diaphragm of steel about 1/16 in. thick screwed into a valve cap; O is the oscillograph; P the mirror 1/64 in. diameter stiffly mounted and submerged in oil to prevent vibration, which gives the representations of the piston stroke, and is operated by a shunt current from the magneto in most cases; D is the diagram which shows by the motion of a spot of light, the pressure at any part of the stroke. It shows when a valve effectively opens and closes, as distinct from the mechanical timing, which is affected by outside influences. By means of a synchronous kinematograph the pressure at one spot can be watched on every explosion over long periods while a car is in actual use. The device is so delicate and so rapid in its operation that it is quite easy accurately to reproduce as a photograph the air oscillations of the human voice, so that the indication of an engine presents no serious difficulty.

A Novel Electric-Truck Body.

The Penn Grains & Feed Co., of Philadelphia, formerly shovelled its dried grain into freight cars from horse-drawn teams. This arrangement has now been abandoned in favour of the use of electric trucks of the type shown in fig. 2, an illustration taken from the *National Electric Light Association Bulletin*. This electric 5-ton standard truck is fitted with a 3-section dump body, and has been so developed that the truck can pull alongside of a freight car, and each section in turn can be dumped through the doorway, thus saving a large part of the labour cost. The truck has otherwise proved very successful.

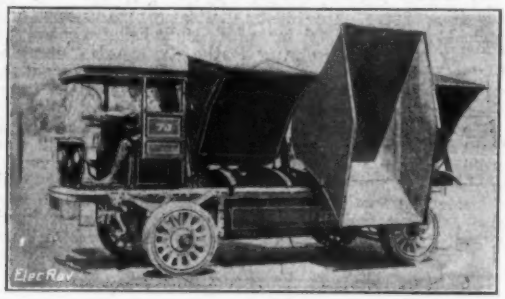


Fig. 2.—Electric Truck with Three-section Dump Body.

There are many potential electric vehicle installations awaiting development in every large city, and the type of vehicle illustrated would appear to have more uses than one. For instance, cement and gravel could be carried together when making concrete, or, again, in the case of a short-weight load having to be transported, the full load could be made up with other substances without mixing, thus enabling the wagon to be used at its full capacity on every journey.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

6,545. "Electrical terminals." J. M. Whiteside. March 17th.
6,561. "Telephone, &c., flexible cords." E. Barrington. March 17th.
6,595. "Contact terminal." A. & O. Cheisi, Sons & Co. March 17th. (Switzerland, March 16th, 1918.)
6,610. "Contacts of electrical switchgear." R. S. O'Neil. March 17th.
6,626. "Adjustable resistances." Eversheds & Vignoles and S. Eversheds. March 17th.
6,641. "Brush-rocking gear and terminal mechanism for dynamo-electric machines." H. D. Rohman. March 17th.
6,643. "Electric vulcanisers, &c." H. Frost & Co. and W. H. Welch. March 17th.
6,654. "Electrically-heated furnaces." Morgan Crucible Co. & C. W. Speirs. March 17th.
6,655. "Protective devices for electric circuits." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 17th.
6,656. "Wireless signalling systems." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 17th.
6,664. "Dynamo-electric machines." H. Chitty. March 17th.
6,705. "Sparking plugs." T. Harvey. March 18th.
6,706. "Electric signalling telegraph." W. F. Grafton & A. D. Jones. March 18th.
6,722. "Electric muffles and furnaces." F. Osbourne. March 18th.
6,727. "Appliances for removing and replacing electric light shades." H. M. Manuel. March 18th.
6,743. "Electric lamps." A. Garbarini. March 18th. (France, July 3rd, 1918.)
6,749. "Unidirectional radio receiving system." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 18th.
6,760. "Electric transformers." H. S. Burn & Ferranti, Ltd. March 18th.
6,781. "Galvanic batteries." G. Oldham & J. Oldham. March 18th.
6,788. "Starting and lighting devices for automobiles, &c." J. Bethenod. March 18th. (France, August 7th, 1918.)
6,838. "Electric steering gear for ships, &c." T. Reid. March 19th.
6,855. "Railway signalling." W. R. Sykes Interlocking Signal Co. and E. S. Tiddeman. March 19th.
6,856. "Railway signalling apparatus." F. V. Russell, W. R. Sykes Interlocking Signal Co. & E. S. Tiddeman. March 19th.
6,864. "Protective devices for electric circuits." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 19th.
6,898. "Installations for electrically lighting, heating and ventilating railway carriages, &c." H. D. Rohman. March 19th.
6,903. "Sparking plugs." T. Lubbock. March 20th.
6,935. "Electric heaters." D. Anderson & C. Scott-Snell. March 20th.
6,942. "Electrical primary cells." P. Dorrian. March 20th.
6,951. "Producing vacua." Western Electric Co. (Western Electric Co., U.S.A.) March 20th.
6,967. "Systems of electric power transmission." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 20th.
7,018. "Ignition apparatus for internal-combustion engines." Soc. Anon. pour l'Equipment Electrique des Vehicules. March 20th. (France, April 18th, 1918.)
7,032. "Electric terminals." Remy Electric Co. March 20th. (U.S.A., April 22nd, 1918.)
7,034. "Ignition apparatus." Dayton Engineering Laboratories Co. March 20th. (U.S.A., March 23rd, 1918.)
7,071. "Electric fuse plugs." J. Glatz. March 21st.
7,102. "Arc lamps." S. E. Crick. March 21st.
7,110. "Antennæ for wireless signalling systems." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 21st.
7,142. "Electrodes for electric arc welding." I. B. Blaiberg. March 22nd.
7,167. "Filament electric lamp." D. W. McCullough. March 22nd.
7,173. "Control of electric motors." W. Brooke & E. M. Kerr. March 22nd.
7,174. "Automatic contactors or electrically-operated switches, &c." W. Brooke & E. M. Kerr. March 22nd.
7,175. "Electrical contactors or switches, &c." W. Brooke & E. M. Kerr. March 22nd.
7,179. "Electric cells or batteries." H. Adkins & A. T. Austin. March 22nd.
7,181. "Electrical switches." J. W. Haram & H. C. Tofield. March 22nd.
7,206. "Method of disinfecting telephone instruments." W. A. Morris. March 22nd.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1914.

24,830. Electric fire control for guns. Pollen & Isherwood. December 31st, 1914.

1915.

895. Electrical receiving apparatus especially intended for use with ordnance. Dawson & Horne. January 19th, 1915.
1,402. Wireless apparatus. F. M. Clarke (Executrix of E. R. Clarke). January 28th, 1915.
8,321. Apparatus for use in wireless telegraphy and the like. Sueter, Groves & Binyon. June 4th, 1915.

1917.

18,476. Holders for incandescent electric lamps. F. Quarmby. February 12th, 1918. (123,544.)
19,041. Electrical apparatus for subjecting articles to varying temperatures. W. E. Prescott & G. R. Baker. December 22nd, 1917. (123,545.)

1918.

3,430. Electric accumulators and the like. V. G. Youricff. February 26th, 1918. (123,582.)
3,433. Regulatable self-induction coils for use in high-frequency circuits. L. Rouset. February 26th, 1918. (123,583.)
3,606. Fittings for electric incandescent lamps. B. J. Grigsby & O. E. Grigsby. February 28th, 1918. (123,596.)
6,342. Railway traffic-controlling apparatus. McKenzie, Holland and Westinghouse Power Signal Co. April 16th, 1917. (115,635.)
6,761. Covers for electric motors. British Thomson-Houston Co. (General Electric Co., U.S.A.) April 22nd, 1918. (123,449.)
6,795. Current-regulating devices for dynamos running at variable speed. H. Wade (Officine Elettro-Meccaniche). April 22nd, 1918. (123,451.)
7,877. Ignition magnetos for internal-combustion engines. H. Lucas and J. H. Chambers. May 10th, 1918. (123,244.)
8,936. Incandescent electric lamps. Osram-Robertson Lamp Works and T. J. Sack. May 30th, 1918. (123,249.)
9,003. Distributors for use with magneto-electric machines. British Thomson-Houston Co. & A. P. Young. May 31st, 1918. (123,468.)
9,578. Method of and apparatus for the manufacture and adjustment of contact plates in Swan lamp bases. H. C. Ghijsen & Naamlooze Vennootschap Vitrite Works. June 11th, 1918. (Addition to 6,055/18.) (123,469.)
9,754. Thermic telephones. Baron van R. A. Lynden & Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. June 13th, 1918. (123,255.)
9,810. Apparatus for producing detonating signals for controlling the operation of trains, trams, and the like. W. L. Rowe. June 14th, 1918. (123,470.)
10,188. Electromechanical arrangement for the distant working of searchlights and other similar appliances. G. Rebora. June 20th, 1918. (123,677.)
11,625. Electric soldering irons. J. G. Clemens. July 16th, 1918. (123,263.)
11,395. Railway signalling. E. P. A. Abric. October 7th, 1916. (117,462.)
12,486. Spark plugs. E. O'Connell. July 31st, 1918. (123,687.)
14,856. Electric meters. E. Bjerknes. September 13th, 1918. (123,286.)
18,746. Moulds and method of casting grids for accumulator electrodes. H. F. Joel. October 16th, 1917. (Divided application on 14,931/17.) (123,701.)
20,518. Rectifying X-ray systems. W. A. Winter. December 10th, 1917. (121,489.)
20,960. Electrically-operated abraiding machine. N. G. Olson. December 16th, 1918. (123,512.)